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No. 1695

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U.S. Ordnance dept.

INSTRUCTIONS FOR MOUNTING  
USING, AND CARING FOR

# DISAPPEARING CARRIAGE

L. F., MODEL OF 1896

FOR

12-INCH GUNS

MODELS OF 1888 AND 1895

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(NINETEEN PLATES)

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AS IT IS

WAR DEPARTMENT,  
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This manual is published for the information and government of the Regular Army and Organized Militia of the United States.

By order of the Secretary of War:

R. BIRNIE,  
*Colonel, Ordnance Department, Acting Chief of Ordnance.*

(3)





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## INSTRUCTIONS FOR MOUNTING, USING, AND CARING FOR DISAPPEARING CARRIAGE, L. F., MODEL OF 1896, FOR 12-INCH GUNS, MODELS OF 1888 AND 1895.

[The points in *italic* are of importance, or concern the safety of the carriage, and should be specially noted.]

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### THE EMPLACEMENT.

The emplacement on which this carriage is mounted is constructed entirely of concrete. Plate II shows the general design of the emplacement, although the shape of the rear of the loading platform varies somewhat with the location of the emplacement and the position of the corridors leading to it. A circle of nine steps leads from the loading platform down to the platform surface on which the carriage is mounted. The counterweight well, around the top of which the base ring rests, is in the center of the platform surface.

The anchor bolts which hold the base ring in place are set in the concrete as the emplacement is constructed. The openings in which the wedges are afterwards set are made with molds and are the depth of the least height of the lower wedge.

### THE CARRIAGE.

The carriage was originally designed to mount the 12-inch gun, model of 1888.

Four carriages, Nos. 11, 13, 14, and 15, were subsequently modified to mount the 12-inch gun, model of 1895, by using an elevating band with a smaller bore and by placing the sighting platform and sight standard on the left side and the ladder and ladder standard on the right, this being the reverse of all carriages with 1888 guns except No. 12. The present sighting platform, attached to all carriages on the left, runs the full length of the carriage, with steps at each end. The sighting platform of the old style, where located on the right, has been retained.

From the new platform the gunner controls the sighting and firing of the piece and also the slow-motion traversing gear.

The carriage permits, in emplacements provided for it, of a field of fire of  $170^{\circ}$  and of  $5^{\circ}$  depression and  $10^{\circ}$  elevation.

PRINCIPAL PARTS.—The carriage consists of the following principal parts, viz: Base ring, azimuth circle, traversing-roller system, racer

chassis, transoms, top carriage, recoil and counter-recoil systems, gun levers, crosshead and counterweight cage, counterweight, counterbalance device, tripping gear, elevating system, traversing system retracting system, electric-motor gear, working platforms, sighting standard platforms, lanyards safety attachment, electric-firing apparatus and accessories, including ammunition trucks, shot tongs, and implements.

**ACTION OF CARRIAGE** (Pls. II, III, and IV).—Upon firing the piece the gun-lever axle moves to the rear, carrying the top carriage with it. The lower ends of the lever move vertically upward, being constrained by the crosshead traveling on the vertical crosshead guides in the chassis. The trunnions of the gun, following the arc of an ellipse, move downward and to the rear.

The energy of recoil is absorbed partly by raising the excess of the counterweight and partly by the movement of the recoiling masses up the inclined chassis rails, but principally by the resistance of the recoil cylinders. When the gun comes to rest, it has the proper loading angle, and the pawl teeth are engaged in the ratchet teeth on the front faces of the crosshead supporting the counterweight.

The elevating system is so constructed that the gun is at an angle of about  $4^{\circ}$  elevation when in the loading position, if recoiled to the thirty-second notch, with any elevation in battery.

After loading, the pawls are tripped, releasing the counterweight, and the excess of its moment over the moment of the gun and recoiling parts raises the gun to the firing position. The amount of this excess determines the velocity of counter-recoil, so that by increasing the counterweight the time required for going into battery will be decreased.

**BASE RING** (Pl. V).—The base ring is of cast iron, in halves, bolted together and secured to the foundation by twelve 2.5-inch bolts around its outer edge and fourteen 2.5-inch bolts around its inner edge. Except where the two parts of the base ring join, these bolts pass through leveling wedges, consisting of a cast-iron shoe resting on the foundation and a forged steel wedge with a sheet-iron cover resting on the shoe and under the edge of the base ring. Each wedge is slotted for the bolt, and may be driven in, for leveling the base ring. The shoes under the joints between the two halves of the base ring have forged steel pins driven into their bolt holes. These pins engage in the slots in the wedges, and a bolt passes through the base ring on each side of the wedge. The base ring has formed on its upper surface the lower roller path, which supports the racer, and an annular flange extending upward, which forms the pintle for the carriage.

An outer dust guard of wrought iron in four sections is bolted to the racer to protect the roller-ring system. This should be removed

occasionally for examining and cleaning the distance ring, traversing rollers, and roller path.

**AZIMUTH CIRCLE AND POINTER (Pl. V).**—A brass azimuth circle, attached by countersunk screws to the top of the pintle of the base ring, is graduated in degrees, the numbers of which are to be added after the carriage is erected in its emplacement. The top of the racer is cut away on the left side to expose the azimuth circle and the azimuth pointer and subscale which is fastened to the racer. The subscale has slotted holes for the special screws which hold it in place, and by means of which it may be adjusted laterally. After adjusting, it is fixed in position by two dowels. It is graduated decimally, the least reading being 5 hundredths of a degree. In the new micrometer pointer and subscale, graduated to 0.1 of a degree, the screw actuating the pointer has a least reading of 0.01 of a degree. This opening has a hinged bronze cover to protect these parts when not in use.

**RACER (Pl. V).**—The racer is made of steel, cast in halves, having an outside diameter of 17.75 feet. On the underside there is an annular flange 2.5 inches thick, which is accurately bored so as to fit over a corresponding flange from the base ring, forming a pintle whose outside diameter is turned so that there is a diametrical clearance of 0.04 inch between the two surfaces. The pintle surface of the racer has spiral oil grooves to facilitate lubricating, and suitable oil holes are provided on the top of the racer, closed by bronze screw plugs. The underside of the racer forms the upper roller path.

The cavities in the upper surface of the racer, formerly filled with cement, will in future be provided with steel cover plates properly roughened, as fast as the cement requires replacement. Drain holes will be placed in the bottom of the cavities.

**TRAVERSING ROLLER SYSTEM (Pl. V).**—The racer rests and is rotated upon a circle of 24 live, conical, traversing rollers of forged steel, running on the lower roller path on the base ring. These rollers are separated by two wrought-iron distance rings, and the system is held concentric by flanges on the inner ends of the rollers. The roller bearings in the distance rings are held in the radial position by 24 cast-iron separator braces, which are bolted to the rings. Roller caps of wrought iron, two under the bearings of each sixth roller, are bolted to the under face of the distance rings, and hold them down in position.

**CHASSIS AND TRANSOMS (Pls. II, IV, and XI).**—The two chassis of cast iron are bolted to the racer, and are united near their middle part by two cast-steel transoms. Vertical crosshead guides are formed on their inner surfaces near their front ends. The upper surfaces of the chassis rails have a slope of  $2^\circ$  to the front, to facilitate the return of the gun to the firing position and to reduce the preponderance of the counterweight. The chassis have U-shaped

recesses, to receive the recoil rollers, in the top flanges, the outer edges of which are extended to enter the top-carriage clips.

**TOP CARRIAGE AND RECOIL ROLLERS (Pl. VI).—**The top carriage is similar to that of an ordinary barbette carriage, and is made of cast steel in one piece. It consists of two side frames united by a transom. The recoil cylinders are cast in these side frames, which also contain the beds for the gun-lever axles. It rests upon two sets of 9 recoil rollers in the recesses in the top of the chassis rails, and projecting just sufficiently to prevent rubbing contact. These rollers are of forged steel, bushed with bronze, and turn on steel axles, which are forced and keyed into openings in the sides of the recess in which the rollers turn. Clips extending under the whole length of the cylinders engage under corresponding flanges on the outside of the chassis rails.

**RECOIL AND COUNTER-RECOIL SYSTEMS (Pls. VII, VIII, and IX).—**The recoil cylinders are lined with cast iron and are 13 inches in interior diameter. Their piston rods are 4.75 inches in diameter, and have their pistons forged solid with them. Each piston has two slots, with Tobin bronze liners partly closed by the throttling bars whose length exceeds the travel of top carriage. The piston rods pass through lugs which project upward from the front ends of the chassis rails, and are secured by the piston-rod nuts and check nuts. The piston rods project through the ends of the cylinders, and are supported in rear by brackets bolted to the ends of the chassis rails. The usual stuffing boxes, with glands and followers, are at the ends of the cylinders. The four throttling bars are of forged steel, and are bolted one on either side of each cylinder by bolts from the outside. Equal resistance and fluid pressure in the two cylinders is secured by an equalizing pipe connecting their front or pressure ends. In this pipe is an emptying coupling by which the entire recoil system may be emptied of oil. From this coupling a connecting pipe extends back to the throttling valve, and from this valve pipes connect with the rear ends of the cylinders.

When the gun is fired the pistons remain stationary, while the top carriage, with the cylinders, moves to the rear.

Only a comparatively small part of the energy of recoil is taken up by the raising of the counterweight and movement of the top carriage up the inclined chassis rails, the greater portion being controlled and taken up by the resistance of the hydraulic cylinders.

This resistance is that which the oil offers to being forced from one side of the piston to the other through the following openings:

1. The clearance between the piston and the walls of the cylinder. This opening is of constant area.

2. The opening of the throttling valve which controls the flow through the pipes connecting the front and rear ends of the cylinders. This opening is of constant area during recoil, but may be



completely closed or changed to suit different conditions of loading, and to correct for any other conditions which would cause a variation in length of recoil.

3. The orifices between the throttling bars and their slots in the piston. These orifices vary with the profile of the throttling bars.

The resistance of the hydraulic cylinders increases with the velocity of the piston and as the area of the orifices decrease. The velocity of retarded recoil is variable, and as a constant resistance is desired the orifices must be varied to give this result. This is accomplished as follows:

The only orifice which is not constant during recoil is the one between the throttling bars and their slots in the piston. The throttling-bars in each cylinder are constructed of constant width, with only a sufficient lateral clearance in the slots for working movement, but their depth varies, the profile being so designed that the orifices (the portion of the slots not filled by the bars) through which the oil flows, increases from the beginning of motion to the point of maximum velocity of retarded recoil. From this point on the velocity of retarded recoil is continually decreasing, and the area of the orifices correspondingly decreases until it becomes zero at the end of recoil. The orifices have at each point of recoil such a relation to the velocity of retarded recoil of the top carriage at that point as to give nearly a constant resistance to the motion of the top carriage. The result is a practically constant fluid pressure in the cylinders.

The areas of the orifices have to be calculated for a peculiar set of conditions of loading, and any variation in these conditions will change the length of recoil of the top carriage, and consequently the height and inclination of the breech of the gun in the recoiled position. As the standard conditions of loading do not always exist, it has been found desirable to provide means for varying the resistance of the hydraulic-recoil brake in order that the prescribed length of recoil to bring the gun into the prescribed loading position may be obtained under any conditions, standard or not standard—as, for example, when reduced charges are fired.

For this purpose the equalizing pipe between the two cylinders is joined to a connecting pipe affording a passage which may be completely closed or changed in area by the *throttling valve*, and by which the oil can pass from one side of the piston to the other, i. e., from one end of the cylinders to the other. *This throttling valve can be adjusted to give openings varying by 0.025 square inch from 0 to 0.55 square inch.* The graduations of the valve are stamped on the top of the body, there being 11 divisions, numbered 0, 0.05, 0.10, etc. *One complete turn of the valve effects a change of 0.05 square inch in the opening. One half turn effects a change of 0.025 square inch. One*

complete turn of the valve yoke generally changes the length of recoil by the equivalent of two or three notches on the crosshead rack. This is liable to vary by a notch or more for different carriages, or for the same carriage under different conditions.

*The setting of the valve best suited to different conditions of loading can be determined only by experience in actual firings with each particular carriage.* Different carriages may require different settings, and the same carriage may even at different times require different settings for the same conditions of loading, if it is in a materially different condition as to cleanness and lubrication of the working parts, etc. It is necessary, therefore, that careful records be kept, not only of the setting of the valve, the conditions of the loading and recoil, but also of the elevation of the piece and any abnormal condition of the carriage which might affect the freedom of its operation. These records should be studied in the light of all these circumstances to obtain perfect working. However, the ammunition trucks are so designed that the loading position may vary somewhat without material inconvenience, and it is generally possible after a few firings with a carriage to determine the setting of the valve which will result in the gun coming into a proper loading position for any conditions of loading. *For full charges the valve should, in the lack of experience with the particular carriage, be opened to about 0.15 square inch, but not more.*

A padlock is provided for locking the valve yoke in any position to guard against accidental or unauthorized changes in the position of the valve after it has been set. The valve should habitually be kept locked, but this should not be understood as discouraging examination and manipulation of the valve, which are, on the contrary, highly desirable for the sake of familiarizing the personnel with its construction and operation.

Each cylinder is provided with one filling plug, and an emptying plug is placed in the coupling of the equalizing pipe. In filling, the filling plugs should be removed from both cylinders so as to permit the air to escape and thus insure the filling of both cylinders up to the filling holes.

The portion of the cylinders above the filling holes (about 300 cubic inches in each cylinder) is intended to be empty. This space allows the oil sufficient room in which to expand when heated by weather or the friction developed in firing, and to provide a space into which the male part of the counterrecoil buffer may be withdrawn. In recoil this withdrawal is accomplished so quickly that the oil can not flow through the small clearances and fill the seat of the buffer without the development of a very high pressure in the cylinders, which would be undesirable.

For all charges, the cylinders should, before firing, be filled to the level of the filling holes as explained above.

A neutral oil, of specific gravity about 0.85 (such as the "hydro-line" at present issued), is used, and with this oil the working pressure in the cylinders is about 1,200 pounds per square inch.

A denser oil would cause a higher pressure in the cylinders and therefore shorten the recoil slightly. About 64 gallons of oil are required to fill the cylinders and pipes of one carriage.

For the purpose of reducing the shock of accidental excessive recoil, recoil buffers, made up of alternate layers of balata and steel plates, are placed on brackets bolted to the rear of the chassis, where they will be struck by the upper ends of the gun levers if the gun moves beyond its proper position during recoil or when retracted. The notches between the ratchet teeth cut on the front faces of the cross-head clips are numbered from the top, the numbers being opposite the notches on brass strips screwed to the crosshead. When the top pawl teeth, indicated by brass arrows screwed to the pawl levers, engage in the 32 notch, the gun is in its calculated loading position, *below which it should not be retracted*. By a proper adjustment of the throttling valve the recoil of the gun should not vary much from this position. The ammunition truck will, however, permit the gun to be loaded anywhere between its position when the pawls engage in the 20 notch, and the lowest possible position—gun levers on the balata counter-recoil buffers.

In case the gun recoils far enough for the pawls to engage, but not sufficiently far for loading, it may be brought down by the use of the retracting gear.

*From the foregoing description of the recoil system it will be evident that should the carriage recoil too freely the proper correction is in a diminution of the opening of the throttling valve, not in an increase of the counterweight. On the other hand, the counterweight alone should be changed to correct or modify the counter recoil.*

The amount of counterweight can be determined by trial. Whatever the amount used it will not materially affect the length of recoil.

*Counter-recoil buffers.*—The female part of the counter-recoil buffers consists of bronze bushings attached to the rear cylinder heads, which fit into the cylinder and are supported by its walls. In the recesses thus formed enter tapering collar plungers attached to the piston rods. When the gun returns, to the firing position, the liquid caught in the recesses in the cylinder heads can escape only through the small clearance between the bushings and these plungers, thus acting as a hydraulic buffer to check the velocity at the end of the return "into battery." At the front end of the chassis rails counter-recoil stops are provided to prevent the bottoming of the projecting

counter-recoil buffers in the annular recesses. Against these stops the top carriage abuts when in the firing position. Lugs project from the lower side of the top carriage, with openings for pinching bars.

If for any cause the top carriage should not come fully into battery, the pinching bars are engaged with the teeth on the chassis rails through the opening in these lugs, which serve as fulcrums for moving the carriage forward. When time permits, the top carriage should always be brought fully into battery (against the stops); but if desired, the gun may be fired when the top carriage is as much as 3 inches out of battery with perfect safety and with no bad results other than inaccuracy in the elevation of the gun, unless its elevation be given by telescopic sight on gun trunnions or by quadrant on the gun.

**GUN LEVERS** (Pls. II, III, and IV).—The trunnions of the gun rest in bronze bushed trunnion beds in the upper ends of the gun levers. The gun levers are made of cast steel, connected near their upper ends by a cast-steel yoke firmly bolted to them. The gun-lever axle is forced into openings in the gun levers near their middle point. The axle supports the gun levers and its projecting ends serve as trunnions which are supported by and turn in the bronze bushed axle beds in the side frames of the top carriage. They are held in the axle beds by bronze bushed axle caps.

**CROSSHEAD AND COUNTERWEIGHT CAGE** (Pl. X).—The lower ends of the gun lever are connected to the crosshead and counterweight cage by crosshead pins about which the gun levers turn.

Crosshead clips formed in one piece with the crosshead are lined with bronze and engage over the crosshead guides on the inside of the chassis rails. These guides constrain the crosshead and counterweight cage to move in a vertical direction. Ratchet teeth are cut on the front faces of the clips and are engaged by the pawls pivoted to the chassis rails, thus supporting the counterweight and preventing the gun from returning to the firing position after recoiling, until the tripping levers are raised.

**COUNTERWEIGHT** (Pl. X).—The counterweight cage swings by the crosshead from the gun levers. It is of cast steel and carries the lead counterweight, which is piled in the cage in nine layers, each consisting of two or more pieces.

There are 94 pieces furnished with each carriage, weighing in all about 141,772 pounds. The total of crosshead, cage, and weights is 160,282 pounds.

The ninth or top layer consists of 68 pieces; 64 of these are hand weights averaging about 84 pounds each. These are fastened together, to prevent unauthorized removal, by a lock and chain, but can be removed easily when desired.

By adding or removing some or all of these smaller weights the counterweight may be increased or diminished. When the counterweight is assembled it forms a pile 8 feet 6.5 inches high, including the bottom of cage.

*The amount of lead counterweight with each carriage is in excess of that required to raise the gun to the firing position under normal conditions.* No matter what the conditions of firing may be, the counterweight used should be such as will raise the gun completely from any position to the firing position without causing the top carriage to strike the counter-recoil stops with great shock. In its lowest position it hangs in a well formed in the platform concentric with the base ring. This well is 12.5 feet in diameter and 5 feet 8 inches or more deep, measured from the under side of the base ring. Access to the bottom of the pit is obtained by means of a manhole and ladder on the right side.

**TRIPPING GEAR (Pl. XI).**—When the gun is in the loading position it is permitted to rise to the firing position by raising the tripping levers until they are latched, and immediately leaving them in that position, by which means the pawls are disengaged from these teeth, the counterweight descends, and the gun is raised to the firing position. When the carriage starts into battery the tripping levers are retained by the safety latch, so that the pawls are held out of the way of the racks until the latter have passed entirely below them. They are then released automatically by the action of the dogs attached to the crosshead, and the moment of the weight of the tripping levers and other parts return them to their proper positions to engage the crosshead when it again rises.

*The tripping levers should not be held up by hand after the carriage starts into battery,* as this would prevent their automatic return to their proper positions during the counter recoil. They are designed so as to be brought automatically to the proper position for engagement during the recoil, if for any reason the levers should be raised and latched while the gun is in battery, but this is not the desired action.

**ELEVATING BAND, ARM, AND RACKS (Pl. XII).**—The elevating arm is of cast steel and has at its upper end two bronze bushed and capped bearings, which support the elevating band and in which its trunnions rest.

The elevating band is of cast steel and surrounds the breech of the gun, to which it is clamped by three bolts, which draws its ends together under the gun. The lower end of the elevating arm has two solid bearings with bronze bushings.

The elevating racks have journals cast on them which support the elevating arm in these bearings and about which the arm turns.

They are of cast steel with tobin bronze liners, and are moved in corresponding openings between the elevating rack guides, which are bolted to the inside of the chassis rail by the elevating gearing system. This movement allows the change in the elevation of the gun from  $5^{\circ}$  depression to  $10^{\circ}$  elevation. A spring plunger buffer is attached to each chassis rail near the bottom of the elevating rack guides, to prevent any shock to the system should the gun run to its maximum elevation with too great velocity. At  $10^{\circ}$  elevation the springs are compressed 3 inches.

Removable rack stop bolts are also provided, which can be so placed in the chassis as to limit the movement of the gun to either  $0^{\circ}$ ,  $2.5^{\circ}$ , or  $5^{\circ}$  depression, as may be required by the parapet over which the gun is to be fired.

Theory requires, in order that the gun shall always return to the same angle for loading, with the breech at the same height, whatever may be the firing angle, that the gun shall recoil to the thirty-second notch, and that the elevating slide and its guideway shall be circular and struck with radii from the center of the journal on the elevating band, when the gun is in the loading position. However, the expenses of manufacturing have made it desirable to construct the racks and guideways straight. These are so placed, however, as to cause only a slight variation in the height of the breech and in the loading angle.

**ELEVATION DISK AND POINTER (Pl. XIII).**—The elevation circle and scale is now made in one piece and of white metal. Those manufactured prior to August 20, 1908, are of aluminum alloy. The disk is keyed to the end of the elevating pinion shaft on the left side of the carriage. At the time of the shop test, the disk is marked to show elevations in degrees for every  $5^{\circ}$  from  $5^{\circ}$  depression to maximum elevation. The actual graduation of the range scale, with a least reading of 20 yards, is done after the carriage is mounted in its emplacement. Direction plates fastened to the sides of the chassis show the direction of movement of handwheels to cause elevation or depression. A bronze elevation pointer, in smooth contact with the graduated wheel, is screwed to the elevation disk bracket. It has slotted holes to give it a lateral motion for adjustment.

**ELEVATING SYSTEM (Pl. XIV).** The elevating shaft which is 10 feet 9 inches long, passes through and turns in roller bushings set in bearings in the chassis. It has a handwheel at each end, to be turned by two men standing on the racer, one on each side of the carriage. This shaft carries one of a set of miters, the other being keyed to the end of the elevating worm shaft. The worm which is forged in one with its shaft turns in bearings in the worm-wheel case, which is bolted to the racer. It is provided with a ball-thrust bearing between the worm and the sleeve nut, the latter holding it in place. This worm engages in the teeth of a bronze worm wheel, which is held between two cast

iron friction disks, the whole being inclosed in the worm-wheel case. These friction disks are keyed to the elevating pinion shaft and turn with it, but have a motion along its length. Their contact with the worm wheel may be tightened or loosened by means of the two clamping nuts on the pinion shaft. The pinion shaft is supported by and turns in roller bushings in bearings one in each chassis. This shaft carries a pinion near each end, which engages in the teeth of an elevating rack. When the handwheel is turned the motion is transmitted through the elevating miters and elevating worm to the worm wheel and the pinion shaft which turns with it.

The pinions turn with the pinion shaft and their teeth engaging in the teeth of the elevating racks raise or lower the racks and with them the elevating arms, thus elevating or depressing the gun.

The elevation disk turning with the pinion shaft indicates the elevation.

The worm-wheel case has three oil plugs—a filling plug, an emptying plug, and between them an observation plug. The case should be filled to the level of the observation plug with a good lubricating oil. The friction clamp should be adjusted so that the contact is sufficient to prevent the elevating racks from running down with the preponderance of the loaded gun, but slipping should occur when a weight greater than 15,000 pounds is applied to the elevating arm, with the gun at  $0^{\circ}$  elevation. The elevating screw may also be actuated by means of a slow motion elevating handwheel adjacent to the elevation disk on the left side of the carriage. This is done through two pairs of bevel gears and two shafts. A foot clutch is provided for engaging or disengaging the slow motion gearing at will.

**ELEVATING GEAR COUNTERBALANCE DEVICE.**—When depressing the gun the breech is raised, and during this operation the men at the elevating handwheel have to overcome the preponderance due to the weight of the elevating arm and other parts which move with it.

When elevating the gun by lowering its breech this preponderance assists instead of opposes the motion.

In order to render the power required for elevating and depressing as nearly equal as possible, each of these carriages is fitted with a counterbalance device. This device consists of a cast-steel frame attached to the racer. In a bearing at one end of the frame is a rope drum which is fastened to and turns with the elevating pinion shaft. At the other end of the frame, overhanging the well, is a guide pulley which turns on a pin in the frame. A steel rope is clamped to and winds in a groove in the drum pulley. This rope passes over the guide pulley and supports at its other end a cast-iron counterbalance. The rope is attached to a bolt passing through the counterbalance, a washer on the lower end bearing against the end of

a spiral spring. This spring is in an opening in the counterbalance, and a washer on top of it bears against the end of this opening. The spring relieves the shock which would otherwise occur due to sudden rotation of the pinion shaft at the time the friction disks slip on the worm gear.

When the gun is being elevated the rope winds on the rope drum and the counterbalance is raised, increasing the effort required at the handwheels.

This effort is reduced when depressing, as in this case the operation is assisted by the weight falling.

**TRAVERSING SYSTEM (Pl. XV).**—A traversing shaft 10 feet 6½ inches long is supported and turns in the roller bushings in bearings in the chassis in front of the retracting shaft. At each end of this shaft is a traversing crank by which it is operated. Keyed to this shaft just inside the right chassis is a bevel pinion which engages with a wheel on a traversing intermediate shaft which extends to the rear at right angles to the traversing shaft. This intermediate shaft turns in roller bearings in a cast-iron bracket bolted to the inside of the right chassis rail. A bevel pinion on the end of this intermediate shaft meshes in a wheel on the end of a traversing pinion shaft, also turning in roller bearings, which extends vertically downward, a pinion on its lower end engaging in the rack on the inside of the base ring.

When the crank handles are turned by men standing on the racer the motion is transmitted through the train of spur gearing to the pinion which is engaged in the traversing rack on the base ring. The rotation of the pinion in the rack causes the racer and all parts carried by it to rotate about the pintle surface.

Stops on the base ring above the traversing rack limit the motion of the carriage in azimuth as may be required by the emplacement on which it is mounted. Two brass plates with the words "right" and "left" and arrows to indicate the corresponding direction in which to turn the cranks are screwed on each side of the carriage above the traversing shaft.

Carriages may also be moved in azimuth by the slow-motion traversing handwheel on the left sighting platform, which actuates the traversing crank through two pairs of bevel gears and two shafts. A foot pedal and clutch is provided for engaging the slow motion gearing.

**RETRACTING SYSTEM (Pl. XVI).**—A retracting crank shaft passing from one side of the carriage to the other is supported in steel bushing in each chassis by roller bushings in which it turns. A drum shaft similarly supported above the crank shaft also turns in roller bearings and has keyed to it two drums, one on either side, to which are clamped the ends of the wire ropes which are wound upon them.



These ropes pass around guide pulleys in rear of the recoil buffers, the loop on the other ends being hooked to the upper ends of the gun levers. When the gun is to be hauled down by hand two removable crank handles are attached to the ends of the retracting-crank shaft and are turned by men standing on the racer. This motion is transmitted through a train of three pairs of spur gears to the drum shaft and the wire rope is wound upon the drums, drawing the gun down from the firing position. A ratchet and pawl prevents the load from overhauling the gearing. These wire ropes remain with the carriage and when not in use are wound upon the drums until the loops are but a short distance from the guide-pulley brackets.

A handwheel is provided on the right end of the retracting shaft for rapid winding and unwinding of the ropes when the gun is not being retracted. To save time, this handwheel should be used to wind up the slack of the ropes previous to retracting and before the crank handles are placed on the shaft.

In hauling down *care should be exercised that each rope is under equal tension*. After taking up the slack in the ropes and putting some strain on them, they should be vibrated slightly, and if found to be unequally loaded, adjustment should be made at the rope clamps on the drums. After the loop of the rope is placed over the hook on the gun levers and while winding up the slack, special care should be taken that the rope is guided to the pulleys without any kinks or any slack and that the coils lie smoothly upon the drums without crossing the ridges between the grooves. Two brass plates with the word "down" and arrows to indicate the corresponding direction in which to turn the cranks are screwed on each side of the carriage just above the retracting shaft.

*The wire ropes should always be detached from the gun-lever hooks before tripping.*

**RETRACTING GEAR, CLUTCH, AND BRAKE.**—To permit the most rapid overhauling of the wire ropes possible there has been added a spring-engaging claw clutch for rotating the drum shaft from the drum gear in retracting. With the clutch thrown off the ropes can be drawn out quickly, revolving the drums and shaft rapidly in the drum gear.

In order to prevent overrunning and injury to the ropes a band brake is added, gripping the hub of the left drum upon lifting a crank handle. The clutch is thrown off by drawing a loop handle on the left side until the feathers are drawn out and permit the handle to be given a quarter turn, which locks the clutch off with the spring compressed. When enough rope is overhauled the brake handle is raised to stop the shaft, the loop is given a quarter turn back to permit the feathers to enter, and the spring moves the clutch, on its feathers in the drum shaft, to engagement.

**ELECTRIC MOTOR AND GEARING (Pl. XVII).**—All of the carriages of this model are equipped with a shunt-wound motor for retracting only. The motor is of the completely inclosed type to run at about 625 revolutions per minute and capable of delivering 8 horsepower for a period of one hour. It stands on 4 feet with bolt holes for securing it to a cast-steel bracket which is attached to the inner side of the left chassis below and in the rear of the retracting crank shaft.

A starting rheostat with a no-voltage release is supplied for starting, stopping, and controlling the motor, and is attached to the left chassis in rear of and above the elevating handwheel. It is inclosed in a metal box to protect it from injury and operates at five different speeds. The rheostat is protected by a fuse of maximum capacity of about 80 amperes.

When the switch of the rheostat is closed, the field of the motor is energized but no current flows through the armature. Now, by moving the lever of the rheostat over the successive contacts the resistance is gradually cut out of the armature circuit until the motor gathers full speed. This should always be done slowly, in 10 to 15 seconds, as by moving the lever quickly to its final position a very large current is allowed to flow through the armature (there being no back E. M. F.) and the insulation may be burned out before the fuses work.

When the lever is in its final position, it is held there by the attraction of an electromagnet which is energized by the field current. Its object is to protect the motor in case of sudden failure of the current from the generator, as in such event the field current of course ceases; this releases the lever and the spring returns it to the "off" position. This of course then prevents a rush of current through the motor when the line current is restored.

The motor is stopped by opening the line switch, and this switch should always remain open when the motor is not in use. If desired, the motor may be slowed down by moving the lever back toward "off."

The motor shaft extends through a bushed bearing in the opening in the chassis and is supported at its outer end by an outer bracket with a bronze-bushed bearing in which it turns. A cast-steel maneuvering lever with its lower end turning about the motor shaft carries between its arms an idler gear turning on a short shaft. A pinion keyed to the motor shaft between the maneuvering lever arm meshes with the idler gear and transmits the motion of the motor armature to the idler. The top of the maneuver lever is engaged in a slot in the maneuver-lever arc, which is bolted to the chassis.

The top of the lever has a movement in this slot and may be pinned in any one of three positions. When moved to the forward position, the idler meshes with a gear wheel on the retracting crank shaft and

the gun may be retracted by the motor. When the lever is in the middle position, the idler is no longer engaged with this gear wheel. *It should never be left unpinned, and should never be shifted when the motor or any part of the gearing is in motion. Care should be taken in shifting that the teeth of the idler are opposite spaces in the gears.*

The idler gear is always in mesh with the pinion on the motor shaft, and therefore when it is engaged in the crank-shaft gear the motor drives the shaft and the mechanism operated thereby.

**PLATFORMS AND LADDERS.**—Four working platforms, flush with the top of the racer, are placed one on each side of the rear of the racer and one on each side between the racer and the chassis. They are strengthened by angle irons and are firmly bolted to the racer, the inner ones being also bolted to the chassis. They are reached by steps at each side and on the right rear.

A guardrail is placed at the rear of the left-hand rear platform. All platforms are roughened to prevent slipping.

A top carriage platform, supported by a post in a socket bolted to the right side of the top carriage, is to be used in pointing the gun when the telescope sight is attached to the trunnion. A tie-rod supports it during recoil.

A short ladder on the right side of the chassis affords access to the top carriage ladder, which, when the gun is in battery, is directly over the chassis ladder. By means of these ladders and of the steps in the gun lever access is had to the top carriage platform and the retraction rope may be attached to the right hook. The same arrangement was formerly also on the left side, but has been removed, as it is no longer necessary, due to the long sighting platform.

**SIGHTING PLATFORMS.**—On the left side of the carriage a platform of plates and angles is supported in front by brackets bolted to the top of the crosshead guides on the chassis and in rear by a standard bolted to the racer and chassis. The brackets and standard are steel castings.

A flight of steps is provided at the front and rear of the platform. Handrails and a screen protect the gunner's body from the elevating arm during recoil. This platform furnishes not only a station for sighting and firing (by electricity), but also a convenient means of access to the gun for placing loops of the retracting ropes on the retracting hooks, for oiling, cleaning, and other purposes.

On the right of all carriages, except Nos. 11 to 15, inclusive, the old sighting platform is retained for convenience in working around the breech when the gun is in battery. This platform is adjustable at three different heights. It is surrounded on three sides by a hand-rail of 1.25-inch rods and has a wire screen on the side nearest the gun to protect the occupant from the elevating arm during recoil. On the right of the remaining carriages the old ladder and ladder stand-

ard at the same location has been retained. Ladders on the right side extending from near the concrete platform, halfway up the sight or ladder standards, over the rear end of the chains afford a means of attaching the retracting rope to the hook on the right gun lever should the piece recoil only enough to allow the pawls to engage.

A ladder is also provided on the sight side, suspended under the inner edge of the platform plate, for conveniently entering the counterweight well.

**SIGHT STANDARD AND TELESCOPIC SIGHT.**—At the top of the sight standard, which also forms a support for the platform on the left, is placed the sight arm bracket. This is a steel casting fitting over the male head of the standard. This bracket extends to the front and forms a pivot and seat for the sight arm and telescope. It is bolted to the top flange of the standard by four bolts which are smaller than the holes in the bracket. A lug on the left side of the base flange of the bracket is caught between two set screws seated in lugs on the standard, and thus the bracket can be given a slight adjustment in rotation, fixing the sight arm parallel to the axis of the gun. On the right of this bracket is attached a bracket to carry the firing pistol.

Just below the sight arm bracket there is also attached to the sight standard a shoulder rest for the gun pointer and the supports for the slow-motion traversing shafts and gears.

In the bracket is pivoted the sight arm which carries the combined bar sight with the 3-inch telescopic sight, model of 1904.

**LANYARD SAFETY ATTACHMENT.**—In lanyard firing an attachment prevents the discharge of the piece before it has risen sufficiently for the shot to clear the parapet. This safety device is attached to the elevating band and consists of an incased reel, upon which a short cable is automatically wound by a spiral spring, and which is locked (except when the piece is in battery) by a ratchet and pawl.

One end of a short lanyard or firing leaf cord is hooked to the primer and the other to the end of this cable. The long lanyard in the hands of the cannoneer is also hooked to this cable. A pull on the lanyard when the gun is out of battery can not unwind the cable, pull the short lanyard, or fire the primer. When the gun rises into battery a cam on the elevating arm passing under the pawl lifts it out of engagement with the reel, which can then be unwound, permitting the primer to be fired.

The initial tension of the spring should be sufficient only to wind up the cable with lanyards attached. To adjust, loosen the nut on the spring shaft and, using a wrench on the squared end of the shaft (projecting from the center of the case), withdraw the locking pin, and wind up or unwind the spring. Then return the locking pin to one of the quarter-turn positions and tighten the nut.

A device on the block acting with the firing mechanism, model of 1903, also prevents possible firing of the primer by lanyard until the breechblock is closed and locked.

The firing circuit obtains its current from a dry-cell battery, one wire from which leads through the safety firing switch to the "ground" near the breech of the gun, the other through the firing pistol and safety firing switch to the primer. Both wires lead up the gun levers and along the gun and are incased in flexible metallic conduits for protection. *The gun should be fired only by closing the circuit at the firing pistol after the circuit has been closed for both wires at the safety firing switch.*

The pistol case incloses not only the contacts brought together by the trigger pull but also a buzzer, enabling the gunner to know that the block is completely closed and the connection complete for firing. Pressing the button over the trigger completes a circuit through a resistance coil and magnet coils of high resistance, these coils being shunted across the trigger contacts. The interrupter and magnet constitute a buzzer. The buzzer current, which is just strong enough to actuate the buzzer but not strong enough to explode the primer, is kept on for an instant only. The ear should be held close to the buzzer to detect the sound. Pulling the trigger completes the circuit independently of the high-resistance buzzer, and permits the passage of sufficient current to fire the piece.

The body of the safety firing switch, carrying two knife blades, is pivoted to a base attached to the chassis, the clips and their base being attached to the top carriage. When "in battery" the clips are directly above the blades and contact is made by raising the blades. The corrugation and bead of the clips and blades will retain them in contact until the top carriage moves to the rear. This motion separates them and causes the blades to drop. It is evident that contact can not be made until the top carriage is in battery or nearly so, its return to within 2.5 inches of the stops permitting the switch to be closed.

**CONDUITS FOR LIGHTS AND TELEPHONE.**—All electrical conductors for the motor, lamps, and telephone upon the carriage enter the counterweight well through a duct a short distance below the base ring. The duct leads to a terminal box bolted to and underneath the base ring and located in a niche in the concrete. Attached to the lower end of the terminal box is a flexible metallic conduit which contains all the conductors leading from the terminal box to the carriage.

This conduit hangs in a loop close to the bottom of the well so as to permit movement of the counterbalance device and to afford sufficient slack to permit traversing of the carriage through the angle of fire. The other end is secured to the vertical pipe conduit near the

center of rotation; thence the individual conductors are led to the several points at which their current is to be used. The wiring system as shown on the diagrams is, as far as possible, inclosed in a conduit system of wrought-iron pipe, fittings, junction boxes, etc., all with interior insulation and outlet insulators at the ends of the pipes. Twisted hooks and thimbles are supplied when necessary to carry wires which are not in conduits. The conductors for the firing circuit are completely inclosed in flexible metallic tubing, entirely separate from other wiring.

The gun telephone is fastened to the outside of the rear end of the left chassis by means of steel braces. It consists of a cast-iron box having a door with a positive lock, and a hole for a one-half-inch pipe tapped in the bottom. There is an inner wooden box containing an induction coil and a condenser and having a fixed tray to hold the head set. The carriages are also prepared to receive the emplacement telephone.

An outlet box, furnished by the Signal Corps, is installed by the Ordnance Department on the left chassis near the telephone for the purpose of connecting the telephone to the wiring system of the carriage. It is provided with a cover attached by four screws and made water-tight by a rubber gasket. Three holes are tapped in the bottom of the box, the middle one for the carriage wires, and one of the other two for the telephone wires. Within the box is a slate base, on which are mounted 10 binding posts, by means of which the carriage wires are connected to the wires leading to the instrument. These wires pass through flexible, water-tight, metallic conduits, which are provided with union connections at each end.

The Signal Corps furnishes and installs the wires from the box to the instrument and their flexible conduits, and makes the connections within the box and instrument.

The lighting circuit is arranged with one incandescent 16-candle-power lamp of standard form, with key socket on each side of the carriage and one in the center. Eight-candlepower candelabra lamps, controlled by one switch, are also placed at the azimuth pointer and the elevation and range scales; there is also one with its own switch at the throttling valve. Three 2-candlepower miniature lamps, controlled by one switch and receiving current through fixed and variable resistances, are used with the 3-inch telescopic sight, model of 1904, for illuminating the scales and cross wires. All lamps are shaded so as to illuminate only the parts intended.

Where 220-volt mains are used the wiring is slightly modified, as shown on diagram.

**AMMUNITION TRUCK AND SHOT TONGS (Pl. XVIII).—**The ammunition is brought to the gun and the projectile wheeled into the breech

recess on ammunition trucks. Three are furnished with each carriage. The shot tray on which the projectile rests is capable of being raised to a suitable height for entering the breech of the gun and is so supported that it may be given the required angle of inclination for bringing the axis of the projectile into alignment with the axis of the piece.

The frame of the truck is built up mainly of angle irons riveted. The shot tray and cartridge shelves are steel plate formed into shape. The truck is supported by three wheels, the front pair being large and most heavily loaded, all of which are rubber-tired. It is provided with a brake for the two front wheels, this brake being operated by hand and arranged conveniently with respect to the truck handles.

Hydraulic buffers are to be attached to these trucks. The buffer will abut against the rear face of the breech in loading and relieve the shock to the truck.

Each battery is provided with one pair of tongs for each trolley installed and two reserve ones in the hands of the district ordnance officer.

The tongs are made of forged steel riveted and bolted together. In order to provide tongs having the least possible height over all, they are designed to use a locking link which must be operated to hold the arms in position on the projectile, and with a gripping dog or eyepiece, the inner toe of which is pressed against the top of the projectile by the upward pull in the eye, thus preventing it from slipping out endwise if not properly balanced.

**GENERAL REMARKS.**—An elevating band for the gun to be mounted and the necessary tools and implements are furnished with each carriage. The pinch bars and retracting cranks are placed on hooks on the sides of chassis. All the tools and accessories, except those too large, necessary for the proper care of the gun and breech mechanism are packed in an armament chest, which also contains on the inside of the lid a list of the articles it contains.

Plates secured to the carriage indicate the proper direction of movement for the handles of the elevating, traversing, and retracting cranks. Instruction plates, located near the filling holes, indicate the proper methods of filling the cylinders. Drainage holes are provided for all pockets, and all axles, bearings, and sliding bearing surfaces are provided with oil holes closed by screw plugs.

The six main bearings—trunnion beds, axle beds, and crosshead pins—are provided with compression grease cups. These cups, by means of a spring-actuated cup-leather plunger, automatically force the lubricant through the passages and distributing grooves under the bearing surfaces.

## ASSEMBLING THE CARRIAGE.

**IMPLEMENTS.**—The assembling requires machines and implements for mechanical maneuvers usually found at forts; but, in addition to falls, blocking, jack, sling chains, etc., shears capable of lifting 13 tons will be found especially convenient.

**GENERAL REMARKS.**—The size of the carriage is such that it must be dismantled for shipment, so that when it arrives at its destination it has to be entirely assembled.

*In assembling the carriage, as in all machinery, no parts should be directly struck with a steel hammer or sledge. Soft metal drifts or copper or lead hammers should be used. In unloading or handling the parts care should be exercised that the edges or finished surfaces do not become upset or burred.*

*When two bearing surfaces are brought together, it is specially necessary that both parts should be absolutely clean, smooth, and free from burrs and well lubricated.*

In mounting the 12-inch disappearing carriage, model of 1896, those parts of the crosshead, inaccessible after mounting, and the buffer plates, will be painted before assembling. These parts, if not thus protected, would rust badly, and the buffer plates would soon become brittle and lose their elasticity. In assembling guides or machined surfaces put on a thin coat of slushing oil. Slush all bolts, threads, and faces of nuts. No slush will be applied to the rollers and paths, as its use would quickly result in the accumulation of dust and dirt, thus causing the parts to become gummed. Simple oiling of the roller bearings is all that is required.

The following description gives a statement of the order in which the parts should be put together rather than a complete enumeration of the details of the operation:

**EMPLACEMENT.**—As the emplacement is constructed the anchor bolts are set in the concrete, so that when it is completed their threaded ends project above the surface of the gun platform in the shallow openings left for the wedges.

**BASE RING.**—Place the cast-iron shoes in these openings and on them the steel wedges and the sheet-iron covers, the anchor bolts passing through the openings in them. The steel wedge should be placed with the anchor bolt in that end of the slot where the wedge is thinnest. Move the base ring, in sections, to its position over the pit by means of skids and rollers, placing the part marked "front" to the front of the battery.

Carefully clean and oil the ends of the base ring halves and see that there are no burrs to prevent the ends being drawn tight. Clean and oil all bolts, nuts, and keys, and bolt the sections securely together.



Then caliper the outside of the pintle, and unless the ring has been strained the diameters ought not to vary from each other by more than 0.01 inch.

If the ring is found to show more than 0.01 inch ellipticity, the surfaces of the joints should be reexamined and, if imperfect, scraped until the base ring can be sprung *round* by tightening the bolts. It is then lowered until it rests on the wedges, the anchor bolts passing through the bolt holes in the ring.

**LEVELING.**—In practice the base ring is leveled as follows: The shoes and wedges are shimmed up under it, and when driven home are again shimmed up, and it is leveled by means of a steel straight-edge and a sensitive machinist level.

Begin at the highest point of the base ring, and, noting that this point is down on clean concrete, or the proper distance below the crest of the parapet, place the straightedge on the inside edge of the turned surface of the lower roller path, the ends of the straight-edge resting on points about two bolt holes apart. Move halfway around in one direction, in this manner leveling by means of the temporary wedges as you proceed. Then return to the starting point and level halfway around in the other direction. This must be continued until the surface is accurately level all the way around. The level should always be halfway between the points on which the straightedge is resting and should each time be verified by reversing it. An inclinometer or other test should be applied radially around on the roller path to show that the ring is not sprung conically. If, after leveling and tightening the anchor bolts, the pintle shows more than 0.01 inch ellipticity, the ring has been strained, and the operation of leveling and tightening must be repeated until the ring is true and level. After the base ring is properly leveled and bolted in place, pour under it a quantity of neat Portland cement. The threads and nuts of the anchor bolts should be carefully cleaned and oiled before the nuts are placed in position. The nuts should be screwed down in succession, a little at a time, to prevent straining the base ring. *Too much care can not be taken in leveling the base ring. If it is not accurately leveled, the carriage will have to be dismounted and the entire work of leveling it and mounting the carriage repeated.*

The racer should not be placed on the base ring until the grouting has set and the final leveling has been completed.

**DISTANCE RING AND TRAVERSING ROLLERS.**—Clean the pintle surfaces, roller paths, rollers, and distance rings. See that the joints of the distance-ring sections are free from burrs, and thoroughly oil the surfaces, also all bolts and nuts; assemble the ring one section at a time, such section being supported on the roller path by its own rollers. After assembling, the roller system should be run around several

times by hand, to see that it works freely and that the rollers do not bind in their bearings in the distance ring and that their flanges do not bind on the inner edge of the roller path.

**RACER.**—Move the racer over its position on the traversing rollers and bolt the sections together, using the same precaution against dirt, etc., as in bolting up the base ring. Caliper the inside of the pintle surface. This, too, should show less than 0.01-inch ellipticity. Lower into position, keeping the racer as nearly level as possible, to prevent the pintle surfaces from jamming.

Attach the dust guard as soon as possible after the racer is in position to protect the rollers and roller path. The racer should then be run around by hand several times to see that it is entirely free in action.

**CHASSIS AND TRANSOMS.**—Move the chassis rails one at a time to their positions on the racer. Put the bolts in place and screw them partly home, leaving a little clearance under the heads, so the rails can be sprung apart slightly to allow the transoms to be lowered into position. This is best done by lowering them between the rails from the top, after which all the transom bolts should be screwed nearly home; the dowel pins should be driven in solid, and all bolts set home by gradually tightening each in succession until all are under sufficient initial tension not to work loose.

**TRAVERSING GEAR.**—The traversing pinion and intermediate shafts can be assembled to their gears and brackets and then bolted to the chassis. The pinion is put on from underneath after shaft is in place. After assembling the traversing gearing, traverse several times around to see that there is still no binding of rollers and that they are evenly loaded, then place the carriage successively at four points 90° apart and at each carefully note that crosshead guides are vertical in both directions and that chassis rails are level across and of the designated slope.

Any variations found by these tests indicate imperfect setting of the base ring—which should be carefully examined and remedied—or else imperfect work on the carriage.

The crosshead guides should be compared with the crosshead and may show a little farther apart at the top than at the bottom, as it is to be expected that the weight of the remaining parts yet to be assembled will close the tops slightly.

**COUNTERWEIGHT AND TRIPPING GEAR.**—The gun may be mounted over the crest of the parapet in the “in battery” position or from the rear in the “out of battery” position. In the first case block up under the position of the weight to support the cage in the lowest position in which the weights can be piled in it, in the latter case until the blocking is about 2 inches below the top of the base ring. Raise the counterweight cage by means of the shears and lower it into

position on the blocking, engaging the crosshead clips over the guides, at the same time being careful not to jam the liners. Pile the first to eighth layers of the lead weights.

Assemble the tripping gear complete.

*If it should ever be necessary to raise or lower the counterweight when the gun is not mounted, it must be done carefully by means of jacks and blocking. The recoil cylinders can not be used as buffers to check the fall of the counterweight without the assistance of the gun as a counter-balance.*

**MOTOR AND RETRACTING GEAR.**—Assemble the retracting motor inside of left chassis. Do this before the through shafts are assembled on the carriage.

As the retracting gearing can be utilized in assembling some of the remaining parts of the carriage, it should be assembled now. The gears and drums are marked, and, in assembling, the shafts should be entered from the right side. On entering the drum shaft, the parts should be engaged in the following order:

Left drum, spring seat, spring, clutch, drum gear, second pinion and gear wheel, and right drum; corresponding gears in order on crank shaft.

**RECOIL ROLLERS AND TOP CARRIAGE.**—The recoil rollers, their pins, and the surfaces of chassis top flanges should now be thoroughly cleaned, burs removed and oiled, and the rollers assembled in place, noting that they revolve freely on the pins.

After thoroughly cleaning and oiling the top carriage it may be lifted and slid into position on the chassis from the rear, being careful not to jam the liners.

Put the nuts and check nuts on the front ends of the piston rods after they have been passed through the lugs in front. The thin nuts should be put on first and screwed down tight, then thick nuts screwed down, after which the thin nuts should be started back hard against the thick ones. Bolt on piston-rod brackets in rear. When the piston rod packing is removed, the carriage should run into battery with slight pushing by a man or two. If this is not the case, do not proceed with the mounting until the apparent binding has been discovered and remedied. The top carriage should be moved forward and back on the chassis rails several times to be sure that it moves freely. The top carriage will usually be received complete with rods assembled and boxes packed and cylinders filled with oil, *but should usually be dismounted for examination, which will necessitate reassembling and repacking.* (See "Care of carriage, general instructions.")

**GUN LEVERS.**—Remove all burs from the ends of the gun-lever axle and thoroughly lubricate both axle and beds. Raise the gun levers with the shears and lower the axle into its beds in the top carriage. Lift the rear ends of the levers and move the top carriage

until the pins engaging the cage and levers can be entered and keyed in place.

**GUN.**—Mount the gun, being careful that there are no burs on the bearing surfaces and that they are properly lubricated. Bolt the cap squares in place, and, if mounted from the rear, secure muzzle of gun to a timber passed through front opening in chassis by means of ropes.

In certain cases it may be more convenient to mount the gun from the front, bringing it over the parapet, breech end first. In this case the counterweight, gun levers, and top carriage having been assembled in the firing position, so that as the gun approaches over the top of the parapet the trunnions will be lowered slightly into their beds, the blocking under the breech will be allowed to remain until the elevating system is entirely assembled. It will be impracticable to change the height of the counterweight before the gun is mounted to balance it.

**ELEVATING GEAR.**—To assemble the elevating gear, first bolt the worm-wheel case, assembled with worm and gear, in position; bolt the front rack guides in position, remove the steel and roller bushing from the left chassis and enter the pinion shaft from left side, engaging the friction disks, split nut, counterbalance device, and right pinion in order named. Slide the shaft through to the right far enough to allow the key nut to be slipped over the end of the shaft. Slide the shaft back into position, engaging the left pinion. The pinions should be marked and always placed same side to a flat on shaft, to insure proper engagement of the teeth. Assemble the elevating shaft and small parts.

**ELEVATING RACKS.**—To put the elevating racks in place remove the right and left rear guides, assemble the racks and elevating arms, move the racks into place from the rear. Care will be necessary on account of the small clearance to prevent cramping. A tooth in each pinion and corresponding spaces in the racks are numbered for convenience in assembling. Otherwise it is necessary to level across the elevating rack journals, which should be on the same level when pinions are properly engaged.

**ELEVATING ARM AND BAND.**—In order to properly assemble a band holes must be drilled, if they are not in the gun when received. Great care is necessary in locating these holes that the axis of the band trunnions shall be in the same plane with and parallel to that of the gun trunnions, and distant 128 inches therefrom. *This should never be done except under the supervision of the Ordnance Department.*

Distances must be measured from both trunnions, and careful inspection made by striding level or otherwise to insure parallelism. It is well to use ground emery and oil between the band and the gun to make the band grip tighter.

After the band is properly placed, screw up bolts through the lugs as tight as possible, and then the set screws, already set into the gun, should be set up to bottom.

After cleaning the band trunnions and removing the cap and top brass from the elevating arm, swing it up and either move the elevating gear or tip the gun, if out of battery, until arm can be engaged and brasses and caps assembled.

**REMAINING PARTS.**—Platforms, standards, ladders, and remaining parts can now be assembled.

**AFTER ASSEMBLING.**—When the carriage is completely assembled and the cylinders filled with oil, carefully inspect it to see that nothing is overlooked, after which remove all blocking under the counterweight or gun, and clean and oil all working and traversing surfaces. Place the retracting ropes over the hooks on the gun levers, trip the pawls, and allow the gun to rise slowly to the firing position against the stops by unwinding the ropes slowly. *Do not attempt this with too much counterweight.* Always detach the ropes from the gun levers immediately after retracting. If the action is satisfactory, the carriage may now be tripped and the gun allowed to run into battery several times to see that everything works properly.

The small pieces in the top of counterweight should be added gradually (about 500 pounds at a time) until the proper amount of counterweight necessary to raise the gun to firing position without material shock on the counter-recoil stops has been determined.

Again inspect and tighten anything which may have become loosened.

**IMPORTANT POINTS.**—After the carriage has been completely assembled and the gun mounted, the following points should be noted, viz:

1. Traverse the carriage each way, and elevate and depress gun to see that they work freely.
2. Examine and clean out all oil holes, noting that they have oil plugs.
3. See that there is not a hard bearing between the rim bases of the gun and gun levers.
4. See that the elevating arm and band are properly assembled, the clearances on each side being the same, and the arm not sprung or twisted.
5. See that the chassis rails and crosshead guides have not been burred.
6. See that the retracting ropes are properly adjusted, follow grooves on drum, and are not twisted.
7. See that the dust guard does not bear against the distance rings or base ring.

8. Adjust counterweight until gun rises as promptly as possible into battery without striking the stops with violence, and noting that the counter-recoil buffers act efficiently.

9. See that the piston rods are parallel to the tops of the chassis rails and also to their inside edges.

10. See that the stops to limit the motion in azimuth and depression are properly placed for the particular emplacement.

11. See that the pawls engage simultaneously on each rack of the crosshead and that the tripping and safety tripping devices function properly.

12. Set the elevation pointer by the use of a clinometer supported by a rest in the muzzle of the gun, and verify the graduation.

13. Orient the gun, add numbers to the degree marks in the azimuth circle, and adjust azimuth pointer to indicate correct azimuth. Muzzle at true south is  $0^{\circ}$  in azimuth and numbers are placed around clockwise to include 359.

14. Adjust the sight standard by means of the counter set screws, so that an accurate telescope placed in the sight holder will sight in the same distant point that it will when placed in the trunnion sight bracket, or that is covered by the bore sight.

15. Note that telescopic sights point in the same horizontal plane when set at the same elevation, and that this elevation agrees with that given by the clinometer supported by a rest in the muzzle of the gun.

16. Traverse the carriage to its extreme positions against the azimuth stops and then haul the gun down to see that nothing will interfere with its recoil in these positions.

17. See that electrical connections have been properly made by trying the motor and lights.

#### CARE OF THE CARRIAGE—GENERAL INSTRUCTIONS.

Carriages should be traversed from time to time through their entire movement. They should not be allowed to stand for long periods set at a particular azimuth, as this might cause uneven settlement of the platform.

The habitual position of guns on disappearing carriages is "from battery," but at intervals the gun should be allowed to rise to the firing position and be elevated and depressed within the limits of the stops.

It is especially required that all parts of the carriages must be kept free from rust *at all times*. If this be allowed to accumulate, its removal from all bearing parts, and especially piston rods, requires particular attention in order that clearances shall not be unduly increased. The use of sandpaper for this purpose is forbidden, and

emery cloth No. 1, being coarse enough for any ordinary rusting, should be used, the rust being softened, if necessary, by kerosene.

The retraction wire ropes should at all times be kept well oiled with raw linseed oil.

If any leakage occurs from the hydraulic recoil system it should be immediately remedied, calling, if necessary, upon the district armament officer for the services of skilled labor.

The repacking of stuffing boxes may be done, when necessary, by trained enlisted men, under the supervision of an officer, but will preferably be done by skilled labor.

Before removing a cylinder head containing a stuffing box, or drawing a piston rod through a stuffing box, the pressure of the packing on the rod should be released by unscrewing the follower several turns.

The vulcanized fiber or copper gaskets between cylinders and their heads should be in good condition, and consequently should be replaced whenever necessary in order to prevent leakage.

Recoil cylinders should be emptied at least every three months and thoroughly cleaned every six months.

**INSTRUCTIONS FOR CLEANING RECOIL CYLINDERS.**—For this cleaning a plumber's hand force pump will be supplied to each Coast Artillery post, with about 10 feet of suction hose and 15 feet of discharge tube.

It will be noted that in no case will it be necessary to remove the packing from a stuffing box to clean the cylinders.

In cleaning, the following order of operations may be followed:

(a) Run gun into battery and remove oil from hydraulic recoil system.

(b) Retract gun until pistons are in the middle of the cylinders; then slack away until the pawls engage in the ratchet teeth on the crosshead; observe that the pawls are properly engaged in the ratchet teeth and that the pistons are not under the filling holes.

(c) Remove the piston-rod brackets from the rear ends of the chassis rails. Take off the two nuts on the front end of each piston rod, remove the rear cylinder head from each cylinder, and carefully remove the rods rearward out of the cylinders. Before removing any part it should be marked so as to insure its being assembled in its correct position.

(d) Thoroughly clean each cylinder from both ends with kerosene oil forced in with a hand pump, then wipe dry with clean cotton waste. Clean the piston rods and stuffing boxes. The equalizing and connecting pipes should be dismantled and thoroughly cleaned by forcing kerosene oil into them with the pump.

(e) Assemble the equalizing and connecting pipes, leaving the throttling valve wide open. Insert each piston rod in its cylinder, exercising great care that it be neither bent nor damaged in any

way, and that the piston does not bind in or burr the walls of the cylinder. Assemble the two nuts on the front end of each rod. Place each rear cylinder head on its rod and move it forward into its seat in the cylinder. Assemble the piston-rod brackets to the chassis and then firmly secure the rear cylinder heads to the cylinders. Properly tighten the four followers of the stuffing boxes and fill the recoil cylinders with hydroline oil. This will require some time, as the oil can enter the parts of the cylinders in rear of the pistons only through the equalizing pipes and the throttling bar orifices. When apparently filled, insert the filling plugs, close the throttling valve, and retract the gun to the loading position. Complete the filling of the cylinders and close the throttling valve to its proper setting.

Carefully inspect all parts dismantled and note that they have been properly assembled. Then trip the pawls and let the gun rise into battery.

The piston-rod nuts should then be loosened to insure the rod being centrally located in the cylinder, and the nuts finally tightened.

The gun should be retracted and tripped several times to insure that all parts are in proper working order.

**REMOVING PACKING FROM STUFFING BOXES.**—(Using extractor, furnished by the Ordnance Department.) Close the extractor around the piston rod and insert the locking pin. Turn the extractor to the left, with pressure on the packing, until the needles are firmly engaged in the packing. Draw the packing out, turning slowly to the left. In the case of a box with interior thread and if the ring is tight, it should be unscrewed and not stripped out by the thread, because unless unscrewed it would catch upon and be injured by the thread.

Extractor bars are provided, to be used for starting the packing from its seat and by inserting the toes of the bars in the rack teeth and prying over the edge of the box, being careful not to injure the thread.

**TO PACK OR REPACK A STUFFING BOX.**—Examine the old packing and discard all unfit for use. If any of the old packing is used it should be put in after the new.

To repack, put on the piston rod one ring 0.75-inch Garlock's "waterproof hydraulic" packing and force it well to the bottom of the stuffing box by a wooden stick and mallet. Treat each layer of the packing in a similar manner, being careful to break joints, until six rings of new packing have been inserted, or an equal amount of new and old when any of the latter is used. Place the halves of the gland on the follower, being careful to note that the halves of the gland do not bind on the screw threads.

*No more force should be used on the spanner wrench than that of two men, and generally that of one man is sufficient. The addition of a pipe to the end of the spanner wrench should not be permitted.*



When the box is properly filled and the follower tightened, there should not be more than 1 inch of space between the flange of the follower and the piece into which the follower is screwed. The follower should be tightened from time to time. If the follower is screwed into the stuffing box too tightly, an unnecessary amount of friction will be produced on the piston rod. When the follower is screwed in until the flange strikes the box, another ring of packing should be inserted.

It is to be expected that a slight amount of oil will soak through and drip from boxes of carriages when not in use. Also when tightening the followers a slight amount of oil will squeeze out of the saturated packing. This oil should be caught and not allowed to render the carriage unsightly.

**FILLING RECOIL CYLINDERS.**—Fill the cylinders with oil, removing for this purpose the two plugs, one in each cylinder. Pour clean neutral oil of specific gravity about 0.85 (such as the "hydroline" now issued to the service) into the hole in one cylinder until it flows out of the hole in the other. Allow any air that may be present to escape, then pour in more oil, until the system is filled to the level of the filling holes.

The cylinders will then be not full, but as nearly full as they are intended to be. The filling holes are intentionally placed below the highest point of the cylinders in order to leave above their level a void (or air space) equal to the volume of the counter-recoil buffer plus a few cubic inches to allow for expansion of the oil when heated by the weather or otherwise.

**SERVICE CONDITION (LUBRICATION, ETC.).**—When the carriage is to be kept in readiness for service, and is in daily or frequent use, all bearing parts must be kept cleaned and lubricated. Special attention should be given to the lubricating of trunnion beds, rollers, pintle surfaces, shaft bearings, and sliding surfaces; gun-lever axle beds, crosshead pins, elevating rack, elevating band trunnions, crosshead guides, and the elevating, traversing, tripping, and retracting mechanisms, including the teeth of all gears.

*The above parts should be lubricated at frequent intervals whether the carriage is maneuvered or not. When carriages are in use for daily drills, a thorough lubrication twice each week should be sufficient for all but the most severely used parts.*

Proper lubricating and cleaning of the traversing rollers and their paths are essential to free workings of the carriage.

*When oiling the rollers or the pintle the carriage must be traversed in order to distribute the oil throughout the whole circumference.*

It will occasionally be necessary to examine all ball and roller bearings to see that the dust guards are in proper place and that the rollers

themselves are clean. If they be found dirty, they may be flushed with kerosene oil; but care must be taken to fill the bearings with synovial oil, after the kerosene has drained away. If the rollers have rusted, the bearings must be taken out, the rollers cleaned, and the bearings reinserted.

This oil is easily removed by the use of burlap or waste dipped in kerosene oil. In order to save oil, a thick coating of slushing oil should be well removed by a scraper before applying the kerosene.

Before applying the slushing oil the surfaces should be thoroughly cleaned so as to be entirely free of rust, water, kerosene, lubricating oil, etc., as the first three would cause rusting underneath the slush, and in the latter case it will run off when heated.

Rollers and roller paths should be cleaned and slushed, the space between dust guards and base rings, if not felted tight, should be corked with oakum or waste to keep out the dust, and any wrench holes inside the base ring should be plugged and corked.

Experience has shown that the recoil cylinders should not be emptied, as in that case the interior walls soon become dry and rusty.

**OIL HOLES.**—Oil holes, where provided, must be cleaned out frequently to keep them free from sand and grit, and will habitually be kept closed by the screw plugs provided, except when in the act of oiling.

*Before oiling at any oil hole, wipe off carefully any grit or dirt near the opening that might be carried down into the bearing by the oil.*

**COMPRESSION GREASE CUPS.**—Where compression grease cups are provided, similar precautions against dirt or grit must be observed. In filling these cups, do not fill the cup completely, but fill only to the bottom of the level at the top of the cup; if too full, the leather packing will be come inverted and will not act as effectively. In putting on the cap, see that the leather-packed follower enters the cup without being caught, cut, or bent by the edge of the cup or otherwise.

Screw the cap down on the cup, using a wrench if necessary to secure sufficient power, until the spring rod projects about 0.25 inch above the top of the cap. Later when the spring has recovered and has moved the follower forward, forcing the grease through the tube into the bearing, which will be indicated by the spring rod being pulled into the cap until its nut touches or nearly touches the cap, it will again be necessary to screw up the cap on the cup until the spring is again compressed. When the cap is screwed nearly home and the spring rod does not project, it is an indication that the cup should be refilled.

## RETRACTION MOTOR SYSTEM.

1. Do not let motor run at full speed near the limits of movement.
  2. Hand cranks should be removed before operating electrically to avoid possible injury to the personnel.
  3. The insulation resistance, voltmeter and ammeter readings, time of retraction, speed of motor, etc., should be observed when the equipment and carriage are in good working order, and notation made.
  4. So far as practicable the conductors and all electrical apparatus and parts with their insulation have been given good metal protection against water and mechanical injury. If water is found within any casing, the cover, gasket, or bushing requires attention.
  5. Every connection should be made with bearing surfaces polished and soldered, and every binding screw should be tightly set up.
  6. Before tripping the gun into battery see that the retracting motor is out of gear. The lever should habitually be moved and pinned in its proper position just before retracting and returned to neutral immediately thereafter.
  7. Keep all gears and working bearings freely lubricated with oil provided. The oil wells should be examined each day before the equipment is used.
  8. When the sliding contacts of switches or rheostat frame become roughened or blackened from long or improper use, smooth and clean them with fine emery and leave a trace of vaseline on the surface.
  9. The conductor resistance of any connection or contact should be at least as small as that of an equal length of adjacent conductor.
  10. The insulation of the system on a gun should be over a megohm, and its amount can be found by means of a voltmeter.
- If a voltmeter whose internal resistance is 15,000 ohms gives 105 volts between dynamo brushes and 5 volts between one side and ground, then insulation of the other side is about  $15,000 \times \left( \frac{105}{5} - 1 \right) = 300,000$  ohms.
- A ground in the system can be localized in a general way by watching the deflection of a voltmeter connecting one side to the ground while eliminating or adding in turn different parts of the circuit. After having by the voltmeter determined in a general way the locality of a leak in the system, the exact determination of the position should be made by using a magneto. For this purpose all power should be cut off from the section containing the leak and each wire of the section in turn disconnected from all others and tested by a magneto, one pole of which should be connected to ground and the other to the wire under test. If the insulation is good, no ring of the magneto bell will occur. In making the test care should be taken

that the ends of the wire do not accidentally become grounded after having been disconnected.

11. The starting rheostat is unreliable if, when the voltage falls, the operating handle does not freely return to the "off" position. Failure to return may be due to roughened or unclean contacts, or to a weak spring on the instrument, or it may be due to the armature adhering to the no-voltage release magnet. A screw in the face of the armature regulates the distance from the magnet and in this way the promptness with which the handle will be released. It should be released when the speed of the motor has fallen one-third.

The contacts must be replaced after long use. Avoid striking the handle on the first step to see if there is current.

12. Oil and dirt will, if not guarded against, soon collect in the interiors of motor, rheostat, and other iron boxes and affect the action of the whole system. *All of the mechanism therein must be kept clean*, all bearings oiled, and sliding contacts smoothed and vaselined. But too much vaseline will increase the burning and blackening of the contacts.

13. Carbon dust from the brushes falling upon the commutator and adjacent parts of the motor is injurious. Pieces of cotton cloth placed against the commutator while running will remove the black deposit. A trace of vaseline should then be put on. If with this care the commutator gets an even brown appearance and the carbons are firmly held under 1-pound pressure by their springs and bear squarely and evenly over its whole end surface, there will be little danger of sparking. If the end of the carbon does not bear evenly, draw back and forth a strip of No. 0 sandpaper slipped between the end and the commutator. Be sure and clean off the scrapings.

14. When through using the electrical equipment, switches should be opened and starting rheostat returned to "off" if not already there.

With 110 volts between the terminals the motor in good order should run empty at its normal speed with about 5 amperes.

Retraction should be made in about 3 minutes with a current between 30 and 40 amperes. About 5 amperes more are required near the end of retraction than at the beginning.

NOTE.—For information regarding paints, oils, cleaning materials, and methods of using same, see Ordnance Department pamphlet, Form 1869. Annual allowances will also be found in this pamphlet.

LIST OF ARTICLES PACKED IN THE ARMAMENT CHEST FOR 12-INCH GUN, STEEL,  
MODELS OF 1888, 1888 M1, AND 1888 MII.

	Class.	Section.		Class.	Section.
1 bar screw driver for breech-plate screws.....	I	1	1 extension pipe handle.....	I	1
3 bar screw drivers for breech-mechanism screws.....	I	1	1 metal scraper.....	I	8
1 tool for unscrewing housing of crank catch.....	I	1	10 pounds cotton waste.....	X	10
1 obturator-nut wrench.....	I	1	4 balls twine, assorted.....	X	10
1 obturator nut clamp-screw wrench.....	I	1	2 pounds copper wire, No. 12.....	X	10
1 cleaning reamer.....	I	8	2 pounds copper wire, No. 16.....	X	10
3 cleaning brushes.....	I	8	1 quire emery cloth, No. 00.....	X	10
1 pin punch.....	I	8	3 wagon sponges.....	X	10
1 fit wrench for obturator spindle.....	I	1	1 file, flat, dead smooth, 8-inch.....	I	8
1 pressure-plug wrench.....	I	1	1 file, round, second cut, 8-inch.....	I	8
1 ring for lifting plate.....	I	1	1 file, half-round, smooth, 8-inch.....	I	8
2 bronze drifts.....	I	8	1 file, three cornered, 8-inch.....	I	8
1 gunner's punch.....	I	8	1 copper hammer.....	I	8
1 gunner's drill.....	I	8	1 boiler maker's hammer.....	I	8
1 gunner's pouch.....	I	8	1 hand mallet.....	I	8
1 pair gunner's sleeves.....	I	8	1 long-handled mallet.....	I	8
1 gunner's lanyard.....	I	8	1 pair cutting pliers, 7-inch.....	I	8
1 box containing firing mechanism.....	I	8	1 monkey wrench, 18-inch.....	I	8
			1 monkey wrench, 12-inch.....	I	8
			3 files, pillar, No. 6, 6-inch.....	I	8
			3 files, three-cornered, No. 4, 6-inch.....	I	8
			3 files, half-round, smooth, 8-inch.....	I	8
			3 files, round, smooth, 8-inch.....	I	8

LIST OF ARTICLES PACKED IN THE ARMAMENT CHEST FOR 12-INCH GUN, STEEL,  
MODEL OF 1895.

1 commercial screw driver.....	I	8	2 pounds copper wire, No. 12.....	X	10
1 obturator-nut wrench.....	I	1	2 pounds copper wire, No. 16.....	X	10
1 obturator nut clamp-screw wrench.....	I	1	10 pounds cotton waste.....	X	10
1 fit wrench for obturator spindle.....	I	1	4 balls twine, assorted.....	X	10
1 pressure-plug wrench.....	I	1	1 file, flat, dead smooth, 8-inch.....	I	8
1 pin punch.....	I	1	1 file, round, second cut, 8-inch.....	I	8
2 bronze drifts.....	I	8	1 file, half-round, smooth, 8-inch.....	I	8
1 gunner's punch.....	I	8	1 file, three cornered, 8-inch.....	I	8
1 gunner's drill.....	I	8	1 copper hammer.....	I	8
1 gunner's pouch.....	I	8	1 boiler maker's hammer.....	I	8
1 pair gunner's sleeves.....	I	8	1 hand mallet.....	I	8
1 gunner's lanyard.....	I	8	1 long-handled mallet.....	I	8
1 cleaning reamer for primer seat.....	I	8	1 monkey wrench, 21-inch.....	I	8
3 cleaning brushes for primer seat.....	I	8	1 pair cutting pliers, 7-inch.....	I	8
1 box containing firing mechanism.....	I	8	1 monkey wrench, 12-inch.....	I	8
1 metal scraper (for removing paint, etc.).....	I	8	3 files, pillar, No. 6, 6-inch.....	I	8
1 quire emery cloth, No. 00.....	X	10	3 files, three-cornered, No. 4, 6-inch.....	I	8
3 wagon sponges.....	X	10	3 files, half-round, smooth, 8-inch.....	I	8
			3 files, round, smooth, 8-inch.....	I	8

LIST OF ARTICLES PACKED IN ARMAMENT CHEST FOR 12-INCH DISAPPEARING CARRIAGE, MODEL OF 1896.

1 double wrench for 2½ and 2 inch nuts.....	I	1	1 locomotive oiler, 1 quart.....	I	8
1 double wrench for 1½ and 1¼ inch nuts.....	I	1	1 double screw driver.....	I	1
1 double wrench for 1¼ and 1 inch nuts.....	I	1	1 box wrench for buffers and cylinder heads.....	I	1
2 spanners.....	I	1	1 box wrench for filling vent and drain plugs.....	I	1
3 hooks for lifting counterweights.....	I	1	2 fork wrenches for filling and vent plugs.....	I	1
2 oilers, half pints.....	I	8			

LIST OF ARTICLES TOO LARGE TO BE PACKED IN ARMAMENT CHEST FOR 12-INCH DISAPPEARING CARRIAGE, MODEL OF 1896.

2 pinch bars.....	I	1	1 double wrench for 3½ and 3 inch nuts.....	I	1
2 wrenches for piston nuts.....	I	1	2 water buckets.....	I	8
1 wrench for elevating friction nuts.....	I	1			

## LIST OF IMPLEMENTS FURNISHED FOR 12-INCH GUNS, MODELS OF 1888 AND 1895.

	Class.	Section.		Class.	Section.
1 rammer and staff.....	I	1	1 combined tompon and muzzle cover.....	I	1
1 rammer and staff, short.....	I	1	1 sponge cover, bore.....	I	1
1 sponge and staff, bore.....	I	1	1 sponge cover, chamber.....	I	1
1 sponge and staff, chamber.....	I	1	1 slush brush.....	I	1
1 sponge and rammer prop.....	I	1	1 steel scraper and socket.....	I	1
1 breech cover.....	I	1			

## LIST OF EQUIPMENT SUPPLIED FOR 12-INCH GUNS, MODELS OF 1888 AND 1895, AND DISAPPEARING CARRIAGES, L. F., MODEL OF 1896.

2 paint pots, 1-gallon.....	X	10	3 sash tools, No. 6.....	X	10
1 sieve for paints and oils.....	X	10	3 brushes, paint, 6/0.....	X	10
2 brushes, wall, 4-inch.....	X	10	2 dusters, painter's, No. 2.....	X	10

## MATERIAL FOR CLEANING AND PRESERVATION OF 12-INCH GUNS, MODELS OF 1888 AND 1895, AND DISAPPEARING CARRIAGES, L. F., MODEL OF 1896.

[All expendable.]

4 gallons superior graphite paint, No. 57, for gun only.....	X	10	50 yards burlap.....	X	10
12 gallons superior graphite paint, No. 38, for carriage only.....	X	10	4 packing needles.....	X	10
6 gallons linseed oil, boiled.....	X	10	2 pounds flax twine.....	X	10
85 pounds light slushing oil, for bore of guns, etc.....	X	10	24 rings, Garlock waterproof hydraulic packing, 4.875 square and 4.75 inside diameter, for piston rods.....	I	1
4 gallons synovial oil and 10 pounds grease forcer lubricant, No. 4, for lubricating carriages.....	X	10	3 rings, Garlock waterproof hydraulic packing, 0.25 square and 1 inch inside diameter, for throttling valve.....	I	1
70 gallons hydroline, for filling cylinders.....	X	10	1 set gaskets, for carriage.....	I	1
20 gallons kero-sene oil.....	X	10	1 quire emery cloth, No. 1.....	X	10
40 pounds cotton waste.....	X	10	1 quire emery cloth, No. 00.....	X	10

## APPROXIMATE WEIGHT OF PARTS FOR 12-INCH DISAPPEARING CARRIAGE, MODEL OF 1896.

Number of pieces.	Name of parts.	Weight.	Number of pieces.	Name of parts.	Weight.
<i>Class I, section 1.</i>			<i>Class I, section 1.</i>		
		<i>Pounds.</i>			<i>Pounds.</i>
1	Base ring, including rack.....	34,290	1	Sight standard, on left side.....	1,210
24	Traversing rollers.....	6,720	1	Ladder standard (on carriages 11, 13, 14, 15 only).....	215
2	Distance rings, with fish plates and bolts.....	2,200	2	Piston-rod brackets.....	315
1	Racer.....	27,937	1	Sighting platform (right side).....	239
1	Dust guard in 4 sections, and screws.....	668	1	Sighting platform (left side).....	600
2	Chassis, with elevating rack guides.....	45,845	2	Outside working platforms with steps, bolts.....	1,060
18	Recoil rollers, with bronze bushings.....	4,320	2	Inside working platforms, angles, and bolts.....	800
18	Roller axles and bushings.....	575	1	Top-carriage platform and post.....	169
1	Top carriage with piston rods, liners, stuffing boxes, throttling bars, and bolts.....	25,500	1	Top-carriage platform base.....	74
2	Gun-lever arms with axle, yoke, cap squares, and bushings.....	23,625	2	Retracting ropes.....	75
1	Front transom.....	2,940	2	Retracting-rope drums.....	430
1	Rear transom.....	2,460	1	Retracting crank shaft, collars, and wheel.....	542
1	Elevating arm and boxes.....	3,180	1	Retracting-drum shaft and keys.....	855
1	Elevating band.....	1,905	1	Drum gear.....	638
2	Buffer brackets with caps, fillers, etc.....	2,685	1	Gear wheel and second pinion for retracting.....	272
2	Elevating racks.....	1,400	2	Retracting cranks.....	135
1	Sight standard, on right side.....	504	1	First pinion for retracting.....	38
			1	Gear wheel and third pinion for retracting.....	477
			2	Handwheels for retracting shaft.....	48

APPROXIMATE WEIGHT OF PARTS FOR 12-INCH DISAPPEARING CARRIAGE, MODEL  
1896—Continued.

Num- ber of pieces.	Name of parts.	Weight.	Num- ber of pieces.	Name of parts.	Weight.
<i>Class I, section 1.</i>			<i>Class I, section 1.</i>		
		<i>Pounds.</i>			<i>Pounds.</i>
1	Rear ladder (right side).....	190	1	Shoulder rest.....	80
2	Side ladder.....	170	1	Slow-motion elevating shafts..	25
1	Ladder for top carriage (1 pair).....	130	1	Slow-motion elevating-shaft brackets.....	200
4	Straps and bolts for rear ladder.....	34	1	Slow-motion elevating gears and covers.....	190
2	Straps for outside platforms.....	75	1	Slow-motion traversing shafts..	130
2	Straps for top carriage.....	87	1	Slow-motion traversing-shaft brackets.....	215
1	Traversing intermediate brack- et, with shaft, bevel gear, pinion, and collar.....	471	1	Slow-motion traversing gears and covers.....	360
1	Traversing shaft, with 3 collars and pinion.....	151		Elevating and traversing clutch levers, rods, stops, etc.	250
1	Traversing pinion shaft, brack- et, pinion, and roller bear- ings.....	655		Electric motor, conduits, junc- tion boxes, switches, etc.....	1,400
2	Traversing cranks.....	59		Studs, bolts, and keys for racer together.....	215
2	Pawl levers.....	600		Roller bearings, bushings, and oil plugs.....	441
1	Pawl-lever crank shaft.....	161			
2	Tripping levers.....	141		Carriage.....	206,516
1	Elevating shaft, with collars and pinion.....	158			
1	Elevation disk and pointer (complete).....	180	1	Counterweight cage and liners.	18,510
2	Elevating handwheels.....	246	2	Pins and keys for counter- weight cage.....	816
2	Elevating rack pinions.....	307	28	Lead weights, including aux- iliary weights.....	137,238
1	Worm-wheel case, worm, and worm-wheel friction disk.....	1,315	64	Lead weights, detachable.....	5,716
1	Elevating pinion shaft, collars, keys, and nuts.....	380			162,280
48	Chassis to racer, 40 bolts, 4 dow- els, and 4 keys.....	458			
50	Bolts for transoms to chassis.....	413		Ammunition trucks (3), 1,150 pounds each.....	3,450
8	Bolts for buffer brackets.....	143		Implements.....	465
1	Sighting platform ladders and railings.....	620			
1	Sight-arm brackets and plat- form brackets.....	910		Total weight of carriage..	372,711

<sup>1</sup> Set.

NAME OF PARTS OF 12-INCH DISAPPEARING CARRIAGE, L. F. MODEL OF 1896, THEIR  
PIECE MARKS, LOCATION, AND MATERIAL OF WHICH THEY ARE MADE.

The parts are listed alphabetically under the following headings: Carriage proper; the electrical equipment, including the firing circuits, firing pistol, safety firing switch; ammunition truck; shot tongs; lan-  
yard attachment; and grease cup.

For parts of the telescopic sight, sight cradle, sight arm, illuminating circuits of the sight, and sight cover  
see Form 1955.

When referring to a part, always mention its piece mark, where given on the list.

Meaning of abbreviations in column of material.

Br.....	Brass.	L.....	Lead.
Bz.....	Bronze.	Mg. I.....	Magnet iron.
C.....	Copper.	M. I.....	Malleable iron.
C. I.....	Cast iron.	S.....	Steel.
C. R. S.....	Cold-rolled steel.	S. B.....	Sheet brass.
C. S.....	Cast steel.	S. I.....	Soft iron.
F.....	Felt.	S. R.....	Soft rubber.
F. S.....	Forged steel.	S. S.....	Sheet steel.
F. V. F.....	Flexible vulcanized fiber.	Sp. S.....	Spring steel.
G. I.....	Galvanized iron.	V. F.....	Vulcanized fiber.
G. W. H. P.....	Garlock waterproof hydraulic packing.	V. R.....	Vulcanized rubber.
G. S.....	German silver.	W. I.....	Wrought iron.
H. R.....	Hard rubber.	W. M.....	White metal.

Piece mark.	Num- ber.	Name of part.	Location.	Material.	Remarks.
	4	Angles.....	On sighting platform.....	S.....	
	2	.....do.....	Under floor plates.....	S.....	1 right and 1 left.
	4	Angle straps.....	For rope guides.....	S.....	
	1	Armament chest.....	In magazine.....	Ash.....	
	2	Arrows.....	On pawl levers.....	Br.....	
	4	Auxiliary weights.....	Under crosshead.....	L.....	
	2	Axle bed bushings.....	In top carriage.....	Bz.....	In halves.
	4	Axle bushings.....	In chassis.....	F. S.....	Riveted in.
	1	Azimuth circle.....	On base ring.....	S. B.....	In pieces as con- venient.
	1	Azimuth cover.....	On racer.....	Bz.....	
	1	Azimuth cover hinge.....	.....do.....	Bz.....	
	1	Azimuth cover hinge pin.....	In cover and hinge.....	S.....	
	1	Azimuth cover lifting ring.....	On azimuth cover.....	W. I.....	Complete (eye and ring).
	1	Azimuth pointer.....	On racer.....	Br.....	Pinned after ad- justment.
	1	Ball thrust bearing.....	In worm-wheel case.....	F. S.....	2 disks.
	2	Band trunnions.....	In elevating band.....	S.....	2010.5 balls.
	1	Base ring.....	Under racer.....	F. S. No. 2.....	For gun, model 1895.
	66	Bolts, countersunk with nuts.....	For distance rings.....	C. I. No. 2.....	In 2 parts.
	32	.....do.....	For distance ring fish- plate.....	S.....	1 x 5.25.
	4	.....do.....	For pit ladder.....	S.....	1 x 4.
	4	.....do.....	For rear ladder.....	S.....	1 x 2.25.
	1	.....do.....	.....do.....	S.....	1 x 2.25.
49D	12	.....do.....	Floor-plate supports to floor plate.....	S.....	1 x 3.75.
	34	Bolts, guide.....	Rack guides to chassis.....	S.....	1 x 2.25.
	8	.....do.....	.....do.....	S.....	1.5 x 9.75 special.
	2	Bolts, key.....	For racer joint.....	S.....	1.5 x 15.5 special.
	2	Bolts, rack stop.....	In chassis.....	S.....	2.5 x 22.
	4	Bolts, special, with nuts.....	For buffer brackets.....	S.....	2 x 4.25 special.
	2	.....do.....	For pawl safety latch.....	S.....	
	4	.....do.....	For traversing interme- diate bracket.....	S.....	1.25 x 5.
	2	.....do.....	.....do.....	S.....	1.5 x 7.125.
48F	8	.....do.....	Platform to brackets.....	S.....	0.75 x 3.
48E	6	.....do.....	Corner braces to brackets.....	S.....	0.75 x 2.625.
48D	8	.....do.....	Railing to platform.....	S.....	0.75 x 2.125.
48G	1	.....do.....	Platform to platform bracket.....	S.....	0.75 x 4.125.
48H	1	.....do.....	.....do.....	S.....	0.75 x 5.625.
	1	Bolts, special.....	In maneuver lever.....	S.....	Complete.
	4	Bolts, tap.....	For traversing stops.....	S.....	1.75 x 4.375.
	64	.....do.....	For dust guard.....	S.....	0.625 x 1.
	32	.....do.....	.....do.....	S.....	0.625 x 0.75.



NAME OF PARTS OF 12-INCH DISAPPEARING CARRIAGE, L. F., MODEL OF 1896, THEIR  
PIECE MARKS, LOCATION, AND MATERIAL OF WHICH THEY ARE MADE—Contd.

Piece mark.	Number.	Name of part.	Location.	Material.	Remarks.
	16	Bolts, tap.....	For roller caps.....	S.....	0.625 x 1.5.
	40	do.....	For chassis to racer....	S.....	2 x 5.
	6	do.....	For buffer bracket to chassis.	S.....	2 x 16.25.
	2	do.....	do.....	S.....	2 x 10.75.
	4	do.....	Angle straps to transom.	S.....	0.625 x 1.25.
	8	do.....	For piston rod brackets.	S.....	
	8	do.....	Buffer bracket to chassis.	S.....	
	50	do.....	Transoms to chassis.....	S.....	
	16	Bolts, tap, special.....	For throttling bars.....	S.....	
	32	do.....	do.....	S.....	
	2	Bolts, tap.....	For pipe straps.....	S.....	0.5 x 1.
	2	do.....	For emptying coupling....	S.....	1 x 2.25.
	2	do.....	For throttling valve.....	S.....	Do.
	4	do.....	Handle to gun lever.....	S.....	1 x 2.
	2	do.....	Yoke to gun levers.....	S.....	3 x 6.
	8	do.....	Gibs to crosshead.....	S.....	0.75 x 1.75.
	4	do.....	For crosshead keys.....	S.....	1.5 x 2.5.
	4	do.....	In top carriage platform base.	S.....	1.25 x 3.
	4	do.....	For bushings in chassis..	S.....	1 x 2.
	8	do.....	do.....	S.....	Do.
	2	do.....	For rope stop.....	S.....	0.5 x 1.25.
	2	do.....	do.....	S.....	0.625 x 1.5.
	8	do.....	For rope clamps.....	S.....	1 x 3.25.
	1	do.....	For brace rod pin.....	S.....	1 x 2.
	3	do.....	For foot plate.....	S.....	1 x 1.75.
	2	do.....	For tap carriage ladder..	S.....	Do.
	2	do.....	For side ladder.....	S.....	Do.
	5	do.....	do.....	S.....	Do.
	2	do.....	For pit ladder brace.....	S.....	Do.
	2	do.....	For sighting platform....	S.....	1 x 2.
	4	Bolts, tap, with F. V. F. washers.	For filling and vent tubes.	Bz.....	1 x 1.25.
	3	Bolts, tap.....	Outlet box to chassis....	S.....	0.375 x 0.75.
	1	do.....	Rope clamp to drum.....	S.....	0.75 x 1.75.
	3	do.....	do.....	S.....	0.75 x 2.5.
	2	do.....	Bracket to racer.....	S.....	1.25 x 3.5.
	4	do.....	do.....	S.....	1.25 x 4.
	2	do.....	Cap to bracket.....	S.....	0.875 x 2.875.
	4	do.....	Outer bracket to chassis.	S.....	1 x 2.5.
	1	do.....	Outer bushing to bracket	S.....	0.5 x 1.
	2	do.....	Bracket to chassis.....	S.....	1.25 x 8.5.
	1	do.....	do.....	S.....	1.25 x 3.
	2	do.....	Pointer to bracket.....	S.....	0.75 x 2.
47J	4	do.....	Sight standard to racer..	S.....	1.5 x 4.5.
47E	2	do.....	Sight standard brace to chassis.	S.....	1.5 x 4.75.
47Q	4	do.....	Platform bracket to sight standard.	S.....	1.25 x 2.25.
47R	1	do.....	do.....	S.....	1.25 x 3.5.
47N	4	do.....	Front bracket to chassis.	S.....	1.25 x 3.375.
47G	4	do.....	Sight arm bracket to sight standard.	S.....	0.75 x 2.125.
49A	12	do.....	Floor plate angles to racer.	S.....	1.175.
49A	8	do.....	Side step to racer.....	S.....	Do.
49M	1	do.....	Floor plate support to chassis.	S.....	0.75 x 1.25.
49A	4	do.....	Inner floor plate to chassis.	S.....	1 x 1.75.
49A	4	do.....	Inner floor plate angle to chassis.	S.....	Do.
50D	1	do.....	Rear ladder brace to chassis.	S.....	1 x 2.5.
50E	1	do.....	do.....	S.....	1 x 2.
50E	2	do.....	Front ladder brace to chassis.	S.....	Do.
52T	2	do.....	Spring seat to clutch....	S.....	0.75 x 5.25.
52K	2	do.....	Slipper rod bracket to chassis.	S.....	0.75 x 2.5.
54C	4	do.....	Lower traversing bracket to sight standard.	S.....	0.75 x 1.75.
54E	4	do.....	Slow motion intermediate traversing shaft bracket.	S.....	1 x 3.
54S	6	do.....	Cover to lower traversing gear bracket.	S.....	0.75 x 2.
54C	4	do.....	Upper traversing gear bracket to chassis.	S.....	0.75 x 1.5.

NAME OF PARTS OF 12-INCH CISAPPEARING CARRIAGE, L. F. MODEL OF 1896, THEIR  
PIECE MARKS, LOCATION, AND MATERIAL OF WHICH THEY ARE MADE—Contd.

Piece mark.	Number.	Name of part.	Location.	Material.	Remarks.
54G	2	Bolts, tap.	Traversing handwheel shaft bearing.	S.	0.75 x 1.5.
54G	4	do.	Shoulder rest to sight standard.	S.	Do.
54N	3	do.	Nut strip to shoulder rest.	S.	0.5 x 1.375.
54Q	7	do.	Cover to slow-motion traversing gear 9 and 10.	S.	0.625 x 1.25.
55C	4	do.	Slow-motion elevating handwheel bracket.	S.	0.75 x 2.5.
55P	8	do.	Cover for elevating handwheel bracket.	S.	0.5 x 1.25.
55C	4	do.	Slow-motion intermediate elevating shaft bracket.	S.	0.75 x 2.5.
55W	4	do.	Cover for slow-motion elevating gears 1 and 2.	S.	0.5 x 1.
55C	3	do.	do.	S.	0.75 x 2.5.
55G	4	do.	Elevating clutch fork bracket.	S.	0.75 x 1.75.
55C	3	do.	Elevating clutch lever bracket.	S.	0.625 x 1.75.
	6	Bolts, with nuts.	For racer joint.	S.	2 x 9.5.
	2	do.	do.	S.	2.5 x 10.
	2	Bolts, with 2 nuts each.	do.	S.	2.5 x 12.5.
	6	Bolts, with nuts.	For base-ring joints.	S.	2.5 x 10.
	6	do.	do.	S.	2 x 9.5.
	4	do.	For sight-standard caps.	S.	
	2	do.	For elevating band.	S.	3.5 x 27.75.
	1	do.	do.	S.	2.5 x 26.75.
	8	do.	In worm-wheel case.	S.	1 x 3.625.
	1	do.	For top-carriage ladder.	S.	1 x 2.25.
	2	do.	For side ladder.	S.	Do.
	2	do.	Bracket to transom.	S.	1 x 3.875.
	1	do.	do.	S.	1 x 5.875.
	2	do.	For elevating band.	S.	3.5 x 28.
	4	do.	Motor to brackets.	S.	0.625 x 3.5.
	4	do.	Motor bracket to chassis.	S.	1 x 5.25.
47D	4	do.	Sight-standard brace to standard.	S.	1.125 x 3.25.
49A	12	Bolts, tap.	Floor-plate supports to racer.	S.	1 x 1.75.
49P	4	Bolts, with nuts.	Rear step to floor-plate angle.	S.	1 x 2.25.
49J	8	do.	Guard-rail post to floor plate.	S.	0.5 x 1.625.
49J	1	do.	Floor-plate support to floor plate.	S.	Do.
50B	2	do.	Rear ladder to sighting platform.	S.	1 x 2.125.
50C	12	do.	Rail connections to rear ladder.	S.	0.625 x 1.75.
50C	12	do.	Rail connections to front ladder.	S.	Do.
50A	2	do.	Front ladder to sighting platform.	S.	1 x 2.5.
52M	2	do.	Brake bracket to chassis.	S.	1 x 5.
52U	2	do.	Shipper fork bracket to transom.	S.	1 x 3.75.
52U	2	do.	Shipper bracket to transom.	S.	Do.
54R	3	do.	Cover to slow-motion traversing gear 5 and 6.	S.	0.75 x 3.
55L	2	do.	Traversing clutch lever bracket.	S.	0.625 x 1.75.
55T	2	do.	Elevating clutch lever stop.	S.	0.625 x 1.625.
55Y	2	do.	Traversing clutch lever stop.	S.	0.625 x 1.375.
	2	Boxes.	In elevating arm.	Bz.	In halves.
	1	Brace rod.	Fortop-carriage platform.	F. S.	
	1	Bracket.	For counterbalance.	C. S.	
	1	do.	For elevating shaft.	C. I.	
	1	do.	For retracting motor.	C. S.	
	1	do.	For elevation disk.	C. I. No. 1.	
52Q	1	Brake band.	On brake lever (52N).	S.	
52L	1	Brake bracket.	On chassis.	C. I. No. 2.	
52N	1	Brake lever.	On brake handle.	C. S.	
	2	Buffer brackets.	On chassis.	C. S. No. 1.	1 right and 1 left.
	2	do.	In chassis for rack buffers.	F. S.	
	2	Buffer caps.	On buffer brackets.	W. I.	

NAME OF PARTS OF 12-INCH DISAPPEARING CARRIAGE, L. F., MODEL OF 1896, THEIR  
PIECE MARKS, LOCATION, AND MATERIAL OF WHICH THEY ARE MADE—Contd.

Piece mark.	Number.	Name of part.	Location.	Material.	Remarks.
	2	Buffer springs.	On rack buffers.	Sp. S.	
	18	Bushings.	In recoil rollers.	Bz.	Forced in.
	2	do.	In chassis for pawl shaft.	Bz.	
	2	do.	In gun levers.	Bz.	
	2	do.	In elevating arm.	Bz.	
	1	do.	In worm-wheel case.	Bz.	
	2	do.	In chassis.	F. S.	For elevating pinion shaft.
	2	do.	In traversing intermediate bracket.	S.	
	2	do.	In chassis.	F. S.	For drum shaft.
	2	do.	do.	F. S.	For retracting crank shaft.
	2	do.	In rope sheaves.	F. S.	Forced.
	1	Bushing.	In guide pulley.	Bz.	
	1	do.	In bracket.	Bz.	For counterbalance.
	1	do.	In piston-rod bracket.	C. I.	For gun, model 1895.
	1	do.	In bracket for elevating shaft.	Bz.	In halves.
	1	do.	For bracket.	Bz.	For retracting motor.
47A	1	do.	In sight standard.	Bz.	
54AA	1	do.	In gear bracket (54H).	Bz.	
54F	1	do.	In shaft bracket (54P).	Bz.	
54A	1	do.	In gear bracket (54D).	Bz.	
54B	1	do.	do.	Bz.	
54J	1	do.	In traversing hand wheel shaft bearing (54M).	Bz.	
55A	1	do.	In elevating hand wheel bracket (56B).	Bz.	
55D	1	do.	do.	Bz.	
55Q	1	do.	do.	Bz.	
55E	1	do.	In intermediate elevating shaft bracket (55E).	Bz.	
	2	Bushings, flanged.	In worm-wheel case.	Bz.	
	1	Button.	do.	Bz.	
	2	Caps.	On elevating arm.	F. S. No. 3.	
	2	Cap squares.	On gun levers.	F. S. No. 3.	
	2	Chassis.	On racer.	C. I. No. 2.	1 right and 1 left.
	1	Clamp.	On rope drum.	C. S.	
52B	1	Clutch.	On drum shaft.	C. S.	
52D	1	Clutch ring.	On drum gear.	C. S.	
56H	1	do.	On elevating shaft.	F. S.	
56K	1	do.	On intermediate traversing shaft (horizontal) (56J).	F. S.	
52F	1	Clutch spring.	In spring seat.	Sp. S.	
56D	1	Clutch stop collar.	On elevating shaft.	F. S.	
56P	1	do.	On intermediate traversing shaft (horizontal) (56J).	F. S.	
	2	Collars.	On pawl lever crank pins.	F. S.	
	10	do.	For pipe connections.	C.	Brazed on pipe.
	4	do.	On elevating shaft.	Bz.	
	1	Collar.	do.	S.	
	1	do.	On elevating pinion shaft.	Bz.	
	2	Collars.	On traversing intermediate shaft.	Bz.	
	3	do.	On traversing shaft.	Bz.	
	1	Collar.	On retracting crank shaft.	Bz.	
	3	Collars.	On drum shaft.	Bz.	
48L	1	Corner brace.	On sighting platform.	S.	
	1	Counterbalance (weight).	On rope in pit.	C. I.	For gun, model 1888.
	1	do.	do.	C. I.	For gun, model 1895.
	2	Counter recoil buffer.	In stuffing-box head.	Bz.	
	1	Counterweight, first layer.	In counterweight cage.	L.	In 8 pieces.
	1	Counterweight, second layer.	do.	L.	In 2 pieces.
	1	Counterweight, third layer.	do.	L.	Do.
	1	Counterweight, fourth layer.	do.	L.	Do.
	1	Counterweight, fifth layer.	do.	L.	Do.
	1	Counterweight, sixth layer.	do.	L.	In 4 pieces.

NAME OF PARTS OF 12-INCH DISAPPEARING CARRIAGE, L. F., MODEL OF 1896, THEIR  
PIECE MARKS, LOCATION, AND MATERIAL OF WHICH THEY ARE MADE—Contd.

Piece mark.	Num- ber.	Name of part.	Location.	Material.	Remarks.
	1	Counterweight, seventh layer.	In counterweight cage...	L.....	In 4 pieces.
	1	Counterweight, eighth layer.	.....do.....	L.....	In 2 pieces.
	1	Counterweight, ninth layer.	.....do.....	L.....	In 68 pieces.
54X	1	Cover (lid).....	For slow-motion tra- versing gears Nos. 9 and 10.	C. I.....	
54Y	1	Cover (body).....	.....do.....	C. I.....	
54T	1	Cover (right).....	For lower traversing gear bracket (54D).	C. I.....	
54U	1	Cover (left).....	.....do.....	C. I.....	
54V	1	Cover (top half).....	For slow-motion tra- versing gears Nos. 5 and 6.	C. I.....	
54W	1	Cover (bottom half).....	.....do.....	C. I.....	
55KA	2	Cover.....	For slow-motion elevat- ing bracket (55B).	C. I.....	
55GA	1	Cover (lid).....	For slow-motion elevat- ing gears Nos. 1 and 2.	C. I.....	
56HA	1	Cover (body).....	.....do.....	C. I.....	
	1	Crosshead and counter- weight cage.	Hung on gun levers.....	C. I. No. 1.....	
	2	Cylinder-head extension.	In armament chest.....	S.....	
	1	Distance rings.....	Between racer and base ring.	W. I.....	Inner and outer.
	2	Dowel pins.....	For azimuth pointer.....	S.....	Driven.
39	.....do.....	For traversing rack.....	S.....	Do.	
4	.....do.....	For chassis to racer.....	F. S.....		
	1	Dowel pin.....	In pointer.....	S.....	
	4	Drain plugs.....	On carriage.....	Bz.....	
	1	Drum gear.....	On drum shaft.....	Bz. No. 3.....	
52A	1	Drum-gear collar.....	.....do.....	F. S.....	
	1	Drum shaft.....	Between chassis.....	F. S. No. 2.....	
	1	Dust guard.....	Between racer and base ring.	W. I.....	In 4 pieces.
	1	Elevating shaft.....	Between chassis.....	S.....	
	1	Elevating worm.....	In worm-wheel case.....	F. S.....	
	1	Elevation disk.....	On spur pinion.....	W. M.....	
	1	Emptying coupling.....	On top carriage.....	Bz.....	
	2	End blocks.....	In pawl levers.....	S.....	
	2	Equalizing and throt- tling pipes.	On top carriage.....	C.....	50 long.
	2	.....do.....	.....do.....	C.....	63.75 long.
	1	.....do.....	.....do.....	C.....	21.625 long.
	2	Eye screws.....	In gun lever axle caps.....	F. S.....	
	2	.....do.....	For gun lever cap squares	F. S.....	
55K	1	Elevating clutch lever pin.	In elevating clutch lever bracket (55J).	S.....	
55V	1	Elevating clutch lever stop.	On outside platform.....	S.....	
55Z	1	Elevating clutch rod....	In elevating clutch rod fork (55AA).	F. S.....	
55S	1	Elevating clutch-rod collar.	On elevating clutch rod (55Z).	C. S.....	For spring.
55AA	1	Elevating clutch-rod fork.	On elevating clutch lever (55U).	C. S.....	
55EA	1	Elevating clutch spring..	On elevating clutch rod (55Z).	Sp. S.....	
	2	Elevating direction plates.	On chassis.....	Br.....	1 right and 1 left.
	2	Elevating friction disks.	On elevating shaft.....	C. I. No. 2.....	
	2	Elevating handwheels...	.....do.....	C. I.....	Hub.
	2	Elevating miter gears...	On elevating and worm shaft.	W. I.....	Rim and spokes.
	1	Elevating pinion shaft..	Between chassis.....	Bz. No. 3.....	
	2	Elevating racks.....	In rack guides.....	F. S. No. 2.....	
	2	Elevating rack pinions..	On elevating pinion shaft.	C. S. No. 1.....	1 right and 1 left.
	3	Elbows.....	On railing.....	Bz. No. 3.....	
	2	.....do.....	For guard rail.....	M. I.....	
	4	.....do.....	For ladder railings.....	M. I.....	
	1	Elevating arm.....	On elevating band.....	M. I.....	
	1	Elevating band.....	On gun.....	C. S. No. 1.....	
	1	.....do.....	.....do.....	C. S. No. 1.....	For model of 1888 gun.
56G	1	Elevating clutch.....	On elevating shaft.....	C. S. No. 2.....	For model of 1895 gun.

NAME OF PARTS OF 12-INCH DISAPPEARING CARRIAGE, L. F. MODEL OF 1896, THEIR  
PIECE MARKS, LOCATION, AND MATERIAL OF WHICH THEY ARE MADE—Contd.

Piece mark.	Num- ber.	Name of part.	Location.	Material.	Remarks.
56FA	1	Elevating clutch fork....	In elevating clutch fork bracket (56H).	Bz.....	
53H	1	Elevating clutch fork bracket.	On sight standard (47L1).	C. I. No. 2....	
56GA	1	Elevating clutch fork pin.	In elevating clutch fork (56FA).	S.....	
56HA	1	do.....	do.....	S.....	
55U	1	Elevating clutch lever....	In elevating clutch lever bracket (55J).	F. S.....	
55J	1	Elevating clutch lever bracket.	On sight standard (47L1).	C. I. No. 2....	
	16	Fillers.....	On buffer bracket.....	Balata.....	
	2	Filling plug instruc- tion plates.	On top carriage.....	Bz.....	
	4	Filling and vent tubes.	do.....	S.....	
	2	do.....	do.....	S.....	
	48	Filling washers.....	On traversing rollers.	Bz.....	Driven.
	4	Fishplates.....	On distance ring.....	W. I.....	
	4	do.....	For dust guard.....	W. I.....	
	2	Flanges.....	For guard rail.....	M. I.....	On outside floor plate.
49N	1	Floor plate support.....	On chassis.....	F. S.....	
	4	Followers.....	In stuffing boxes.....	Bz.....	
	10	do.....	For pipe connections.....	Bz.....	
	1	Foot plate.....	On top carriage.....	F. S.....	
47M	1	Front bracket.....	On chassis.....	C. S. No. 1....	
50H	1	Front ladder.....	On sighting platform.....	S.....	Complete.
	2	Gaskets.....	For stuffing box.....	F. V. F.....	
	2	do.....	do.....	F. V. F.....	
	2	do.....	For filling and vent tubes.	F. V. F.....	
	2	do.....	do.....	C.....	
	10	do.....	For pipe connections.....	F. V. F.....	
	1	Gear (idler).....	In maneuver lever.....	Bz. No. 3.....	
	1	Gear wheel.....	On third pinion.....	Bz. No. 3.....	
	1	do.....	On second pinion.....	C. S. No. 2....	
	4	Gibs.....	In crosshead.....	Tobin Bz.....	
	4	Glands.....	In stuffing-box head.....	F. S.....	In halves.
	1	Gland.....	For throttling valve.....	Bz.....	
	2	Graduation strips.....	On crosshead.....	Bz.....	1 right and 1 left.
	1	Guide pulley.....	For counterbalance rope.....	C. I. No. 2....	
	1	Guide pulley bolt.....	In the guide pulley.....	F. S. No. 2....	With nut and washer. Complete.
48K	1	Guard chain.....	On platform railing.....	S.....	
	1	Gun lever axle.....	On top carriage.....	F. S. No. 3.....	
	2	Gun lever axle caps.....	do.....	F. S. No. 3.....	
	1	Handle.....	On gun lever.....	W. I.....	
	64	do.....	In ninth layer of weights.....	F. S.....	Cast in.
	1	do.....	In retraction handwheel.....	S.....	
	1	Idler shaft.....	In maneuver lever.....	S.....	
49G	1	Inside floor plate.....	On racer.....	F. S.....	Right.
49H	1	do.....	do.....	F. S.....	Left.
56L	1	Intermediate traversing shaft (vertical).	In brackets on sight standard.	F. S. No. 1....	
	2	Keys.....	Traversing pinion shaft.....	S.....	
	2	do.....	In drum shaft.....	S.....	For clutch, staked.
	4	do.....	In retracting crank shaft.....	S.....	
	1	Key.....	For retraction hand- wheel.	S.....	
	1	do.....	In guide pulley bolt.....	S.....	
	1	do.....	For ratchet.....	S.....	
	1	do.....	For idler shaft.....	S.....	
	2	Keys.....	For clutch ring (52D).....	S.....	
	2	do.....	For shipper rod (52Z).....	S.....	Riveted on. 0.375 sq.
	1	Key.....	For intermediate trav- ersing shaft (56J).	S.....	
	2	Keys.....	do.....	S.....	Snug in shaft. 0.375 sq.
	2	do.....	For intermediate trav- ersing shaft (56L).	S.....	
	2	do.....	For intermediate elevat- ing shaft (56Q).	S.....	Do.
	1	Key.....	For traversing hand- wheel shaft (56R).	S.....	Do.
	2	Keys, gib.....	For pawl shaft.....	S.....	
	4	do.....	In drum shaft.....	S.....	For drums.
	1	Key, gib.....	For retraction gear.....	S.....	
	2	Keys with screw nuts.....	For collar on drum shaft.....	S.....	For use only on left side of car- riage having short drum with separate collar.

NAME OF PARTS OF 12-INCH DISAPPEARING CARRIAGE, L. F., MODEL OF 1896, THEIR  
PIECE MARKS, LOCATION, AND MATERIAL OF WHICH THEY ARE MADE—Contd.

Piece mark.	Num- ber.	Name of part.	Location.	Material.	Remarks.
	2	Keys.....	In base ring joint.....	S.....	
	4	do.....	Between chassis and racer.....	S.....	
	18	do.....	In roller axles.....	S.....	Staked in.
	2	do.....	In racer joint.....	S.....	
	4	do.....	Buffer bracket to chassis.....	S.....	
	2	do.....	For sight standard.....	S.....	
	1	Key.....	For ladder standard.....	S.....	
	2	Keys.....	For pawl shaft.....	S.....	Do.
	2	do.....	For gun-lever axle.....	S.....	
	2	do.....	Pins to crosshead.....	F. S.....	
	2	do.....	In elevating shaft.....	S.....	
	2	do.....	do.....	S.....	Do.
	1	Key.....	In elevating pinion shaft.....	S.....	Do.
	2	Keys.....	do.....	S.....	
	2	do.....	In traversing shaft.....	S.....	Do.
	2	do.....	do.....	S.....	
	2	do.....	In traversing intermedi- ate.....	S.....	
	1	Ladder standard.....	In piston-rod bracket.....	C. S.....	Used on carriages 11, 13, 14, 15 only.
48C	1	Latch.....	On throttling valve.....	Bz.....	
48A	1	Loft corner post.....	On sighting platform.....	F. S.....	
	1	Loft platform.....	On standard and bracket.....	S.....	Complete.
	24	Leveling wedges.....	Under base ring.....	F. S.....	
	24	Leveling wedges covers.....	Over leveling wedges.....	S. I.....	0.1 thick.
	2	Leveling wedges pins.....	In shoe under joint.....	F. S.....	Driven.
	24	Leveling wedges shoes.....	Under base ring.....	C. I. No. 2.....	
	2	Lifting bolts.....	For counterbalance.....	S.....	
	8	Liners.....	In piston.....	Tobin Bz.....	
	13	do.....	In top carriage.....	Tobin Bz.....	
	12	do.....	On elevating racks.....	Tobin Bz.....	6 pairs.
	4	Liners (wide).....	In crosshead.....	Tobin Bz.....	
	4	Liners (narrow).....	do.....	Tobin Bz.....	
	2	Linings.....	In cylinders.....	C. I. No. 1.....	
	2	Loops.....	On retracting ropes.....	F. S.....	
	1	do.....	On counterbalance rope.....	F. S. No. 2.....	
54D	1	Lower traversing gear bracket.....	On sight standard.....	C. S. No. 1.....	
	1	Maneuver lever.....	On motor bracket.....	C. S.....	
	1	Maneuver lever arc.....	Bolted to chassis.....	C. I.....	
	2	Maneuver lever arc studs.....	In chassis.....	S.....	With nuts.
	1	Name plate.....	On top carriage.....	Bz.....	Lettered to suit model of gun used.
	2	Nuts.....	On elevating pinion shaft.....	F. S.....	1 split half through.
	2	do.....	On traversing pinion shaft.....	F. S.....	
	1	Nut.....	For dowel pin.....	S.....	On elevating pointer.
52AA	1	do.....	For shipper rod (52Z).....	S.....	
56M	1	do.....	On elevating hand wheel shaft (56T).....	S.....	
56M	2	Nuts.....	On traversing hand- wheel shaft (56R).....	S.....	
56M	1	Nut.....	On traversing shaft (vertical) (56L).....	S.....	
54L	1	Nut strip.....	On shoulder rest (54Z).....	Bz.....	
	2	Oilers, half pint.....	In armament chest.....	S.....	
	1	Oiler, locomotive, 1- quart.....	With carriage.....	S.....	
	3	Oil pipes.....	In second pinion.....	Br.....	
	33	Oil plugs.....	In carriage.....	Bz.....	0.5 standard.
	13	do.....	do.....	Bz.....	0.375 standard.
	1	Outer bracket.....	On chassis.....	C. S.....	
	1	Outer bushing.....	In outer bracket.....	Bz.....	
49K	1	Outside floor plate.....	On racer.....	F. S.....	Right.
49L	1	do.....	do.....	F. S.....	Left.
	1	Padlock.....	For throttling valve.....		Yale standard No. 853.
	2	Pawls.....	In chassis.....	F. S. No. 3.....	
	2	Pawls, buffer blocks.....	In pawls.....	Bz. No. 4.....	
	12	Pawls, buffer springs.....	do.....	Sp. S.....	In pairs.
	2	Pawls, levers.....	In chassis.....	F. S.....	
	2	Pawls, levers, cranks.....	On pawl shaft.....	F. S.....	
	2	Pawls, levers, cranks, pin.....	In pawl lever crank.....	F. S. No. 3.....	
	2	Pawl pin.....	In chassis.....	F. S. No. 3.....	
	2	Pawls, safety latch.....	On chassis.....	F. S.....	1 right and 1 left.

<sup>1</sup> Pairs.

NAME OF PARTS OF 12-INCH DISAPPEARING CARRIAGE, L. F., MODEL OF 1896, THEIR  
PIECE MARKS, LOCATION, AND MATERIAL OF WHICH THEY ARE MADE—Contd.

Piece mark.	Num-ber.	Name of part.	Location.	Material.	Remarks.
	2	Pawls, safety-latch dog..	On crosshead.....	F. S. ....	
	1	Pawl shaft.....	Through chassis.....	F. S. ....	
	4	Pawls, springs.....	In pawls.....	Sp. S. ....	
	1	Pawl stud.....	In chassis.....	S. ....	
	1	Pawl stop pin.....	do.....	S. ....	
	2	Pinch bars.....	In armament chest.....	F. S. ....	
	1	Pinion, first.....	On retracting crank shaft.....	Bz. No. 3.....	
	1	Pinion, second.....	On drum shaft.....	F. S. ....	
	1	Pinion, third.....	On retracting crank shaft.....	F. S. ....	
	1	Pinion.....	On motor shaft.....	S. ....	For retracting.
	6	Pins.....	For pawl safety latch dog.....	S. ....	Driven.
	2	do.....	For pawl lever crank pin.....	S. ....	Do.
	2	do.....	For pawl pins.....	S. ....	0.625 x 7, driven.
	24	do.....	In axle-bed bushings.....	Bz. ....	Driven.
	4	do.....	For filling and vent tubes	S. ....	0.25 x 0.75.
	1	Pin.....	For throttling valve latch.....	S. ....	Riveted.
	2	Pins.....	For gun lever bushing.....	S. ....	Driven.
	15	do.....	For trunnion bed bushing.....	Bz. ....	Do.
	2	do.....	Crosshead to gun levers.....	F. S. No. 2.....	Do.
	2	do.....	For rack buffers.....	S. ....	Do.
	16	do.....	In worm-wheel case.....	Bz. ....	For flanged bushing.
	24	Pins (taper).....	In loops on retracting ropes.....	S. ....	12 each.
	1	Pin.....	For top of brace rod.....	F. S. ....	On top carriage platform.
	1	do.....	For bottom of brace rod.....	F. S. ....	Do.
	24	Pins (taper).....	For counterbalance rope.....	S. ....	Do.
	2	do.....	In guide pulley.....	Bz. ....	Driven.
	1	Pin.....	In bracket and bushing.....	Bz. ....	For counterbalance.
	1	do.....	In bushing.....	S. ....	Piston-rod bracket.
	2	Pins.....	In bushing and motor bracket.....	Bz. ....	
	1	Pin.....	In bracket.....	F. S. No. 3.....	For spiral spring.
	1	do.....	In spur pinion.....	F. S. No. 3.....	Do.
	1	do.....	In bracket.....	S. ....	For spur-pinion stud.
	4	Pins.....	In sight standard.....	S. ....	0.75 x 2.5, driven.
	2	do.....	do.....	Bz. ....	For bushing.
	1	Pin.....	In shipper fork bracket.....	Bz. ....	
	3	Pins.....	In traversing gear bracket (54D).....	Bz. ....	0.25 x 0.75.
	2	do.....	In traversing shaft bracket (54P).....	Bz. ....	0.25 x 1.
	1	Pin.....	In traversing gear bracket (54H).....	Bz. ....	0.25 x 0.75.
	1	do.....	In traversing shaft bearing (54M).....	Bz. ....	0.25 x 0.625.
	2	Pins.....	In elevating handwheel bracket (55B).....	Bz. ....	0.25 x 0.875.
	1	Pin.....	In elevating clutch-rod fork (55A.A).....	Bz. ....	
	1	do.....	In traversing clutch-rod fork (55B.A).....	Bz. ....	
	1	do.....	In traversing clutch-rod fork (55C.A).....	Bz. ....	
	7	Pipes.....	For railing.....	W. I. ....	
	10	do.....	For railing posts.....	W. I. ....	
	3	do.....	For guardrail.....	W. I. ....	On outside floor plate.
	6	do.....	For front ladder railing.....	W. I. ....	
	6	do.....	For rear ladder railing.....	W. I. ....	
	10	Pipe connections.....	Onequalizing and throttling pipe.....		Complete.
	6	Pipe plugs.....	For filling and vent holes.....	M. I. ....	
	3	do.....	In worm-wheel case.....	Bz. ....	
	2	Pipe straps.....	For equalizing pipe.....	W. I. ....	
	2	Piston-rod bracket.....	On chassis.....	C. S. ....	1 right and 1 left.
	2	Piston and rod.....	In cylinders.....	F. S. No. 3.....	
	1	Pit ladder.....	In pit.....	F. S. ....	Complete.
	2	Pit-ladder braces.....	Pit ladder to racer.....	F. S. ....	1 right and 1 left.
	14	Plates.....	On buffer bracket.....	W. I. ....	
	1	Plate.....	For sighting platform.....	S. ....	Roughed.
	1	Platform bracket.....	On sight standard.....	C. S. No. 1.....	

NAME OF PARTS OF 12-INCH DISAPPEARING CARRIAGE, I. F., MODEL OF 1896, THEIR  
PIECE MARKS, LOCATION, AND MATERIAL OF WHICH THEY ARE MADE—Contd.

Piece mark.	Num-ber.	Name of part.	Location.	Material.	Remarks.
	2	Plugs.....	In top of standards.....	C. I.....	Driven and staked in.
	4	.....do.....	For filling and vent tubes.	Bz.....	2 extra.
	1	.....do.....	For emptying coupling.	Bz.....	
	6	.....do.....	To replace pipe connections.	Bz.....	
	1	Pointer.....	On bracket.....	Bz.....	
	1	Pointer edge.....	On pointer.....	Bz.....	
	1	Post.....	In top carriage platform base.	C. S.....	
48M	1	Post and screen connection.	Part of railing.....	F. S.....	
	1	Racer.....	On base ring.....	C. S. No. 1.....	
	4	Racer cover plates.....	On racer.....	S.....	Surface roughed.
	2	Rack buffers with nuts.....	In buffer brackets.....	F. S.....	
	4	Rack guides.....	On chassis.....	C. S. No. 1.....	2 pairs.
50F	6	Rail connections.....	For rear ladder.....	F. S.....	
50G	6	.....do.....	For front ladder.....	F. S.....	
	1	Ratchet and pawl.....	On retraction crank shaft.	F. S.....	
	1	Rear ladder.....	On right chassis.....	F. S.....	Complete.
	1	.....do.....	On sighting platform.....	S.....	
50J	1	Rear step.....	On outside floor plate (49K).	F. S.....	
49Q					
	18	Recoil rollers.....	In chassis.....	F. S. No. 3.....	
	2	Retracting crank fastenings, complete.	On retracting crank.....	S.....	2 split pins, 2 chains, 2 rings, and 2 screw eyes.
	2	Retracting crank handles.	.....do.....	Br.....	Seamless tubing.
	2	Retracting crank hooks.....	On chassis.....	S.....	
	1	Retracting crank (left).....	On retracting crank shaft.	F. S.....	With washer riveted on.
	1	Retracting crank (right).....	.....do.....	F. S.....	Do.
	1	Retracting crank shaft.....	Between chassis.....	F. S. No. 2.....	
	2	Retracting drums.....	On drum shaft.....	C. I. No. 2.....	1 right and 1 left.
	2	Retracting ropes.....	On retracting drums.....	S.....	
	2	Retraction direction plates.	On chassis.....	Br.....	Do.
	1	Retraction gear.....	On retraction crank shaft.	C. S. No. 2.....	
	1	Retraction handwheel.....	.....do.....	Bz.....	
28	1	Rings.....	For stuffing boxes.....	G. W. H. P.....	0.875 square.
	2	.....do.....	For throttling valve.....	G. W. H. P.....	0.25 square.
10	1	.....do.....	For pipe connections.....	S.....	
8	1	.....do.....	For traversing gear.....	F.....	Cut to suit groove.
	8	.....do.....	For elevating gear.....	F.....	Do.
22	1	Ring separators.....	In distance ring.....	C. I. No. 2.....	
8	1	Rivets.....	For pawl lever and end blocks.	S.....	
	1	Rivet.....	In valve stem.....	Br.....	
13	1	.....do.....	Liners to crosshead.....	Br.....	Narrow liner.
23	1	.....do.....	.....do.....	Br.....	Wide liner.
48	1	.....do.....	Liners to elevating racks.....	Br.....	
	2	.....do.....	Keys to drum shaft.....	S.....	
	2	.....do.....	In spiral spring.....	S.....	
	2	.....do.....	In pointer edge.....	Br.....	
12	1	.....do.....	In elevation disk.....	S.....	
12	1	.....do.....	In railing posts.....	S.....	
50	1	.....do.....	In sighting platform.....	S.....	0.375 diameter.
	6	.....do.....	For screen.....	S.....	0.375 diameter.
	4	.....do.....	For floor plate angles.....	S.....	0.625 diameter.
	2	.....do.....	Stop to inside floor plate.....	S.....	0.625 diameter.
	2	.....do.....	For shipper rod keys.....	S.....	
10	1	.....do.....	In brake band (52Q).....	S.....	
4	1	Rivets, countersunk head.	For top carriage platform.	S.....	
	1	.....do.....	In outside floor plate.....	S.....	
36	1	.....do.....	On pawl lever crank pin.	Bz.....	
14	1	Roller.....	In chassis.....	F. S. No. 3.....	3 diameter.
	2	.....do.....	.....do.....	F. S. No. 3.....	3.25 diameter.
	2	.....do.....	.....do.....	F. S. No. 3.....	3.5 diameter.
	2	Roller bearings.....	In rope sheaves.....	Bz.....	With 13 steel rollers each.
	2	.....do.....	For elevating pinion shaft.	Bz.....	With 16 steel rollers each.
	2	.....do.....	For elevating shaft.....	Bz.....	With 11 steel rollers each.



NAME OF PARTS OF 12-INCH DISAPPEARING CARRIAGE, L. F., MODEL OF 1906, THEIR  
PIECE MARKS, LOCATION, AND MATERIAL OF WHICH THEY ARE MADE—Contd.

Piece mark.	Number.	Name of part.	Location.	Material.	Remarks.
48B	2	Roller bearings.....	For traversing intermediate shaft.	Bz.....	With 13 steel rollers each.
	2	.....do.....	For traversing shaft.....	Bz.....	With 11 steel rollers each.
	2	.....do.....	For traversing pinion shaft.	Bz.....	With 20 steel rollers each.
	1	Roller bearing.....	For pinion on drum shaft.	Bz.....	With 36 steel rollers.
	2	Roller bearings.....	For pinion on crank shaft.	Bz.....	With 28 steel rollers each.
	2	.....do.....	For drum shaft.....	Bz.....	With 22 steel rollers each.
	2	.....do.....	For crank shaft.....	Bz.....	With 15 steel rollers each.
	8	Roller caps.....	Under distance ring.....	W. I.....	
	1	Rope.....	For counterbalance.....	S.....	
	4	Rope clamps.....	On retracting drums.....	F. S.....	2 right and 2 left.
	1	Rope drum.....	On elevating pinion shaft.	C. I.....	
	2	Rope guides.....	On rear transom.....	S. S.....	1 right and 1 left.
	2	Rope sheaves.....	In buffer bracket.....	C. I. No. 2.....	
	1	Rope socket.....	In rope drum.....	F. S.....	
	2	Rope stops.....	On retracting drums.....	C. S.....	Do.
	1	Screen.....	On railing.....	S.....	Complete.
	8	Screws.....	For filling plug instruction plate.	Bz.....	
	2	Screws, button head.....	For name plate.....	Bz.....	
	38	Screws, cap.....	Liners to top carriage.....	Bz.....	0.625 x 2.75.
	58	.....do.....	.....do.....	Bz.....	0.625 x 2.25.
	60	Screws, countersunk head.....	For azimuth circle.....	Bz.....	
	5	.....do.....	For azimuth cover hinge.....	Bz.....	
	54	.....do.....	For racer cover plates.....	Bz.....	
	16	Screws, countersunk.....	For piston liners.....	Bz.....	
	4	.....do.....	For retraction direction plates.....	Bz.....	
	8	.....do.....	For traversing direction plates.....	Bz.....	
	8	.....do.....	For elevation direction plates.....	Bz.....	
	18	.....do.....	For graduation strips.....	Bz.....	
	8	.....do.....	For bushing to bracket.....	Bz.....	0.5 x 0.75.
	1	Screw driver.....	In armament chest.....	F. S.....	Double.
	2	Screws, fillister head.....	Stuffing box to top carriage.....	S.....	0.75 x 1.
	1	.....do.....	For sleeve nut.....	S.....	0.5 x 0.75.
	2	Screws, headless.....	For stuffing-box head.....	S.....	0.5 x 0.75.
	2	Screws, special.....	For azimuth pointer.....	W. I.....	Washer head.
	6	.....do.....	For arrow to pawl lever.....	Br.....	
	1	Separator.....	Between bracket and chassis.....	C. I. No. 1.....	
	1	Set screw.....	In nut on elevating pinion shaft.	S.....	
	2	Set screws.....	For collars.....	S.....	0.875 x 1.75.
	1	Set screw.....	For rope drum.....	S.....	0.75 x 2.5.
	2	Set screws, special.....	For sight arm bracket.....	S.....	0.75 x 2.75.
	2	.....do.....	In elevating band.....	S.....	
	2	.....do.....	For band trunnions.....	S.....	1.125 x 5.5.
	2	.....do.....	For elevating band.....	S.....	2.5 x 12.
	55R	1 Set screws, cupped.....	For elevating clutch rod collar.	S.....	0.625 x 1.25.
	2	Sheave pins.....	In buffer bracket.....	F. S. No. 2.....	
52W	1	Shipper bracket.....	On front transom.....	C. I.....	
52E	1	Shipper fork.....	In shipper fork bracket.....	C. S.....	
52X	1	Shipper fork bracket.....	On rear transom.....	C. I.....	
52C	1	Shipper handle.....	On shipper rod.....	Bz.....	
52Z	1	Shipper rod.....	In shipper-rod brackets.....	Bz.....	
52J	1	Shipper-rod bracket.....	On chassis.....	C. I.....	
52G	1	Shipper-rod collar.....	On shipper rod.....	S.....	
54H	1	.....do.....	.....do.....	S.....	
54Z	1	Shoulder rest.....	On sight standard.....	C. I. No. 2.....	
49E	1	Side ladder.....	On chassis.....	F. S.....	Complete.
49E	2	Side steps.....	On racer.....	F. S.....	
49E	2	.....do.....	.....do.....	F. S.....	
49E	3	S-hooks.....	In armament chest.....	F. S.....	For counterweight.
47F1	1	Sight-arm bracket.....	On sight standard.....	C. S. No. 1.....	
47K	2	Sight-arm pins.....	In sight-arm bracket.....	Bz.....	With nuts.
47K	1	Sight standard.....	In right piston-rod bracket.....	C. S.....	On right side.
47L1	1	.....do.....	On racer.....	C. S. No. 1.....	On left side in 2 parts.

NAME OF PARTS OF 12-INCH DISAPPEARING CARRIAGE, L. F., MODEL OF 1896, THEIR  
PIECE MARKS, LOCATION, AND MATERIAL OF WHICH THEY ARE MADE—Contd.

Piece mark.	Number.	Name of part.	Location.	Material.	Remarks.
	2	Sight-standard caps.....	On sight standard.....	C. S.....	
	2	Sight-standard gibs.....	In sight-standard caps.....	F. S.....	
	1	Sighting platform, complete.	On sight standard.....	F. S.....	Not used on carriages Nos. 11, 13, 14, and 15.
56X	2	Sleeves.....	On slow-motion handwheels (56BA) (56CA).	Aluminum.....	Part of handle.
	1	Sleeve nut.....	In worm-wheel race.....	Bz.....	
55B	1	Slow-motion elevating handwheel bracket.	On chassis.....	C. S. No. 1.....	
56Q	1	Slow-motion intermediate elevating shaft.	In brackets outside chassis.	F. S. No. 1.....	Left side.
56BA	1	Slow-motion handwheel.	On slow-motion elevating handwheel shaft (56T).	Aluminum.....	
56CA	1	.....do.....	On slow-motion traversing handwheel shaft (56R).	Aluminum.....	
54P	1	Slow-motion intermediate traversing shaft (horizontal) bracket.	On chassis.....	C. S. No. 1.....	
55F	1	Slow-motion intermediate elevating shaft bracket.	.....do.....	C. S. No. 1.....	
56R	1	Slow-motion traversing handwheel shaft.	In top of sight standard (47L1).	F. S. No. 1.....	
56DA	1	Slow-motion traversing gear No. 5.	On traversing crank shaft.	Bz. No. 3.....	
56EA	1	Slow-motion traversing gear No. 6.	On slow-motion intermediate traversing shaft (horizontal) (56J).	F. S. No. 3.....	
56E	1	Slow-motion traversing gear No. 7.	.....do.....	Bz. No. 3.....	
56F	1	Slow-motion traversing gear No. 8.	On intermediate traversing shaft (vertical) (56L).	F. S. No. 3.....	
56U	1	Slow-motion traversing gear No. 9.	.....do.....	Bz. No. 3.....	
56V	1	Slow-motion traversing gear No. 10.	On slow-motion traversing handwheel shaft (56K).	F. S. No. 3.....	
56B	1	Slow-motion elevating gear No. 1.	On elevating shaft.....	Bz. No. 3.....	
56C	1	Slow-motion elevating gear No. 2.	On slow-motion intermediate elevating shaft (56Q).	F. S. No. 3.....	
56S	1	Slow-motion elevating gear No. 3.	.....do.....	Bz. No. 3.....	
56T	1	Slow-motion elevating gear No. 4.	In slow-motion elevating handwheel bracket (56B).	F. S. No. 3.....	And shaft.
56J	1	Slow-motion intermediate traversing shaft (horizontal).	In brackets outside chassis.	F. S. No. 1.....	On left side.
	2	Spanner wrenches.....	In armament chest.....	F. S.....	For stuffing boxes.
	4	Split pins.....	For sheave pins.....	S.....	0.5 diameter.
	2	.....do.....	For pawl shaft.....	S.....	0.375" diameter.
	2	.....do.....	In elevating shaft.....	S.....	
	2	.....do.....	For traversing shaft.....	S.....	
	2	.....do.....	For brace-rod pin.....	S.....	On top carriage platform.
	1	Split pin.....	In pawl stud.....	S.....	
	2	Split pins.....	In sight-arm pins.....	S.....	
	1	Split pin.....	In pin (52V).....	S.....	
	1	.....do.....	In pin (52P).....	S.....	
	1	.....do.....	In taper pin.....	S.....	For brake lever.
	2	Split pins.....	For clutch (52B).....	S.....	
	1	Split pin.....	For shipper rod (52Z).....	S.....	
	1	.....do.....	For taper pin.....	S.....	Shipper handle.
	2	Split pins.....	For elevating handwheel bracket (55B).....	S.....	
	1	.....do.....	For intermediate elevating shaft bracket (55F).....	S.....	
	2	.....do.....	For elevating clutch lever pin (55K).....	S.....	
	2	.....do.....	For traversing clutch lever pin (55N).....	S.....	
	2	.....do.....	For traversing clutch rod pin.....	S.....	
	2	.....do.....	For traversing clutch rod fork pin.....	S.....	
	2	.....do.....	For elevating clutch rod fork pin.....	S.....	

NAME OF PARTS OF 12-INCH DISAPPEARING CARRIAGE, L. F. MODEL OF 1896, THEIR  
PIECE MARKS, LOCATION, AND MATERIAL OF WHICH THEY ARE MADE—Contd.

Piece mark.	Number.	Name of part.	Location.	Material.	Remarks.
	1	Split pin.....	For taper pin in elevating gear No. 2 (256C).	S.....	
	1	.....do.....	For taper pin in elevating gear No. 3 (56S).	S.....	
	1	.....do.....	For taper pin in elevating gear No. 4 (56T).	S.....	At end of shaft.
	1	.....do.....	For taper pin in traversing gear No. 5 (56DA).	S.....	
	1	.....do.....	For taper pin in traversing gear No. 6 (56EA).	S.....	
	1	.....do.....	For taper pin in traversing gear No. 8 (56F).	S.....	
	1	.....do.....	For taper pin in clutch stop collar (56D).	S.....	
	1	.....do.....	For taper pin in clutch stop collar (56F).	S.....	
	1	.....do.....	In intermediate traversing shaft (vertical) (56L).	S.....	
	2	Split pins.....	In traversing handwheel shaft (56R).	S.....	
	2	.....do.....	In traversing clutch fork pin (56AA).	S.....	
	2	.....do.....	In elevating clutch fork pin (56GA).	S.....	
	2	.....do.....	In elevating clutch fork pin (56HA).	S.....	
	1	Spiral spring.....	In spur pinion.....	Sp. S.....	
	1	Spring.....	In counterbalance weight.	S.....	For gun, model 1888.
	1	.....do.....	.....do.....	S.....	For gun, model 1895.
	1	Spring bolt.....	.....do.....	F. S.....	With 2 nuts.
52S	1	Spring seat.....	On drum shaft.....	C. I.....	
	1	Spring washer (top).....	In counterbalance weight.	C. I.....	For gun, model 1888.
	1	.....do.....	.....do.....	C. I.....	For gun, model 1895.
	1	Spring washer (bottom).....	.....do.....	C. I.....	For gun, model 1888.
	1	.....do.....	.....do.....	C. I.....	For gun, model 1895.
	1	Spur gear.....	On elevating pinion shaft.	C. I. No. 1.....	155 teeth.
	1	Spur pinion.....	On spur pinion stud.....	Bz. No. 3.....	149 teeth.
47C1	1	Spur pinion stud.....	In bracket.....	F. S.....	
	1	Standard brace.....	Between sight standard and chassis.	C. S. No. 1.....	
	16	Staples.....	In layers of weights.....	F. S.....	Cast in.
	24	.....do.....	.....do.....	F. S.....	Do.
	1	Stem.....	For throttling valve.....	Br.....	
56W	2	Stems.....	On slow-motion handwheels (56BA), (56CA).	F. S.....	Part of handle.
	2	Stops.....	On inside floor plate.....	F. S.....	For tripping lever.
49F	2	Strips.....	In pointer.....	G. S.....	For zero marks.
	4	.....do.....	For brake band (52Q).	S.....	
52R	32	Studs.....	For stuffing-box heads.....	S.....	
	4	.....do.....	In elevating arm.....	S.....	
	2	Studs, special.....	In chassis.....	S.....	
	4	Studs, with nuts.....	For gun lever axle caps.....	S.....	
	4	.....do.....	For gun lever cap squares.....	S.....	
	8	.....do.....	Yoke to gun levers.....	S.....	
	3	.....do.....	For sighting platform.....	S.....	Not used on carriages Nos. 11, 13, 14, and 15.
	6	.....do.....	For worm-wheel case.....	S.....	
	2	Stuffing box.....	In top carriage.....	Bz.....	
	2	Stuffing-box head.....	.....do.....	C. S. No. 2.....	
	5	Taper pins.....	In elevating shaft.....	S.....	
	3	.....do.....	In elevating pinion shaft.....	S.....	
	1	Taper pin.....	In maneuver lever.....	S.....	
	1	.....do.....	In bracket.....	S.....	0.062 x 1.375.
	1	.....do.....	In spur-pinion stud.....	S.....	0.279 x 3.625.
	1	.....do.....	In spur gear.....	S.....	0.581 x 5.5.
	1	.....do.....	For brake lever.....	S.....	0.279 x 3.687.
	1	.....do.....	For shipper handle.....	S.....	0.208 x 2.25.
	2	Taper pins.....	In elevating handwheel bracket (55B).	S.....	
	1	Taper pin.....	In intermediate elevating shaft bracket (55F).	S.....	
	1	.....do.....	In slow-motion elevating gear No. 2 (56C).	S.....	0.279 x 3.125.

NAME OF PARTS OF 12-INCH DISAPPEARING CARRIAGE, L. F., MODEL OF 1896, THEIR  
PIECE MARKS, LOCATION, AND MATERIAL (OF WHICH THEY ARE MADE)—Contd.

Piece mark.	Num- ber.	Name of part.	Location.	Material.	Remarks.
	1	Taper pin.....	In slow-motion elevating gear No. 3 (56S).	S.....	0.279 x 3.125.
	1	do.....	In slow-motion travers- ing gear No. 8 (56F).	S.....	0.279 x 3.125.
	1	do.....	In slow-motion travers- ing gear No. 5 (56DA).	S.....	0.398 x 4.
	1	do.....	In slow-motion travers- ing gear No. 6 (56EA).	S.....	0.279 x 3.125.
	1	do.....	In clutch stop collar (56D).	S.....	0.398 x 3.25.
	1	do.....	In clutch stop collar (56P).	S.....	0.279 x 2.625.
	5	Tees.....	Cn railing.....	M. I.....	
	8	do.....	For ladder railings.....	M. I.....	
	4	Throttling bars.....	In cylinders.....	F. S.....	
	2	Throttling tubes.....	On top carriage.....	S.....	
	1	Throttling valve.....	do.....	Bz. No. 3.....	
	6	Tool hooks.....	Cn chassis.....	S.....	
	1	Top carriage.....	do.....	C. S. N. 2.....	
	1	Top-carriage ladder.....	On top carriage.....	F. S.....	Complete.
	1	Top-carriage platform.....	On post on top carriage.....	F. S.....	
	1	Top carriage platform base.....	Cn top carriage.....	C. S.....	
	1	Transom (front).....	Between chassis.....	C. I. No. 1.....	
	1	Transom (rear).....	do.....	C. I. No. 1.....	
	1	Traversing bevel wheel.....	On traversing intermedi- ate shaft.....	C. I.....	
56N	1	Traversing bevel pinion.....	On traversing shaft.....	Bz.....	
	1	Traversing clutch.....	On slow motion inter- traversing shaft (56J).	S.....	
56Z	1	Traversing clutch fork.....	In sight standard.....	Bz.....	
56AA	1	Traversing clutch fork pin.....	do.....	S.....	
	1	Traversing bracket.....	On chassis.....	C. S.....	
55X	1	Traversing clutch lever.....	In traversing clutch lever bracket (55M).	F. S.....	
55M	1	Traversing clutch lever bracket.....	Cn sighting platform.....	C. I. No. 2.....	
55N	1	Traversing clutch lever pin.....	In traversing clutch le- ver bracket (55M).	Bz.....	
55DA	1	Traversing clutch lever stop.....	Cn sighting platform.....	S.....	
55BA	1	Traversing clutch rod.....	In traversing clutch rod fork (55CA).	F. S.....	
55CA	1	Traversing clutch rod fork.....	On traversing clutch le- ver (55X).	S.....	
55JA	1	Traversing clutch rod weight.....	Cn traversing clutch rod (55BA).	C. I.....	
	2	Traversing cranks.....	Cn traversing shaft.....	F. S.....	And washers.
	2	Traversing crank han- dles.....	Cn traversing crank.....	Br.....	Tubing.
	2	Traversing direction plates.....	Cn chassis.....	Br.....	1 right and 1 left.
54M	1	Traversing handwheel shaft bearing.....	Cn shoulder rest (54Z)...	C. I. No. 2.....	
	1	Traversing intermedi- ate bevel wheel.....	Cn traversing pinion shaft.....	C. I.....	
	1	Traversing intermedi- ate bevel pinion.....	Cn traversing interme- diate shaft.....	Bz.....	
	1	Traversing intermedi- ate bracket.....	Cn chassis.....	C. I.....	
	1	Traversing intermedi- ate shaft.....	In traversing interme- diate bracket.....	F. S. No. 2.....	
	1	Traversing pinion shaft.....	In traversing bracket.....	F. S. No. 2.....	
	1	do.....	Cn traversing pinion shaft.....	Bz. No. 3.....	
	1	Traversing rack.....	In base ring.....	F. S.....	In pieces as con- venient.
	24	Traversing rollers.....	In distance ring.....	F. S. No. 3.....	
	1	Traversing shaft.....	Between chassis.....	S.....	
	2	Traversing stops.....	Cn base ring.....	W. I.....	
	2	Tripping levers.....	Cn pawl shaft.....	F. S.....	
	2	Trunnion bed bushings.....	In gun levels.....	Bz.....	1 right and 1 left.
54K	1	Tube (without fabric).....	Cn shoulder rest (54Z)...	S. R.....	
54J	1	Upper traversing gear bracket.....	Cn sight standard (47L1)	C. S. No. 1.....	
	1	Valve.....	In throttling valve.....	S.....	
	1	Valve seat.....	do.....	S.....	
	2	Washers.....	In retracting crank shaft bushing.....	Bz.....	Forced in.

NAME OF PARTS OF 12-INCH DISAPPEARING CARRIAGE, L. F., MODEL OF 1896, THEIR  
PIECE MARKS, LOCATION, AND MATERIAL OF WHICH THEY ARE MADE—Contd.

Piece mark.	Num-ber.	Name of part.	Location.	Material.	Remarks.
55FA 56Y 56A	1	Washer.....	For brace rod.....	S.....	Cn top carriage platform.
	2	Washers.....	Under bolts.....	S.....	For pointer.
	1	Washer.....	On elevating clutch spring (55EA).....	S.....	
	2	Washers.....	On stem (56W).....	F. S.....	Special.
	1	Washer.....	On elevating shaft.....	Bz.....	
	2	Weights.....	On counterbalance.....	C. I.....	For gun, model 1888.
	2	.....do.....	.....do.....	C. I.....	For gun, model 1895.
	1	Worm wheel.....	In worm-wheel case.....	Bz. No. 3.....	
	1	Worm-wheel case.....	On racer.....	C. I. No. 2.....	With cover.
	1	Wrench, box.....	In armament chest.....	F. S.....	For buffer cylinder head.
	1	.....do.....	.....do.....	F. S.....	For drain plugs.
	1	Wrench, double.....	.....do.....	F. S.....	1 inch and 1.25 inches.
	1	.....do.....	.....do.....	F. S.....	1.5 inches and 1.75 inches.
	1	.....do.....	.....do.....	F. S.....	2 inches and 2.5 inches.
	1	.....do.....	.....do.....	F. S.....	3 inches and 3.5 inches.
	1	Wrench, monkey.....	.....do.....	S.....	10 inches.
	1	Wrench, single.....	.....do.....	F. S.....	For elevating friction nuts.
	2	.....do.....	.....do.....	F. S.....	For piston - rod nuts.
	2	.....do.....	.....do.....	F. S.....	For filling and vent plugs.
	1	Yoke.....	On throttling valve.....	Bz.....	
	1	.....do.....	Between gun levers.....	C. S. No. 1.....	

## SHOT TONGS (7 PER CARRIAGE).

A8G	1	Claw, inner.....	Opposite outer claw (A8H).....	S.....	In 2 parts.
A8H	1	Claw, outer.....	Pivoted on center pin (A8M).....	S.....	Do.
A8L	1	Dog.....	.....do.....	S.....	
A8M	1	Pin center.....	In claws and dog.....	S.....	
A8J	1	Pin shackle.....	In shackle and outer claw.....	S.....	
A8K	2	Separators.....	Between 2 parts of outer claw.....	S.....	Riveted to claw.
	3	.....do.....	Between 2 parts of inner claw.....	S.....	Do.
	1	Shackle.....	On shackle pin and outer claw.....	S.....	
	2	Split pins.....	In shackle pin.....	S.....	
	2	.....do.....	In center pin.....	S.....	
	1	Spreader.....	In outer claw.....	S.....	
	1	.....do.....	In inner claw.....	S.....	

## GREASE CUP (6 PER CARRIAGE).

A2A	1	Body.....	Screwed into carriage.....	Bz.....	
A2B	1	Cap.....	On upper end of body (A2A).....	Bz.....	
A2D1	1	Cup leather.....	Underneath plunger (A2E1).....	Leather.....	
A2E1	2	Gaskets.....	Underneath body (A2A).....	C.....	0.125 x 0.5, driven.
	1	Pin.....	In plunger (A2E1).....	Bz.....	
	1	Plunger.....	In body (A2A).....	Bz.....	
	1	Plunger nut.....	On plunger (A2E1).....	Bz.....	
A2G	1	Screw.....	Cup leather to plunger.....	Bz.....	
A2H	1	Split pin.....	For plunger and plunger nut.....	S.....	
A2F	1	Spring.....	Between cap (A2B) and plunger (A2E1).....	S.....	
A2C1	1	Washer.....	Under cup leather (A2D1).....	Bz.....	

## LANYARD ATTACHMENT.

Piece mark.	Num-ber.	Name of part.	Location.	Material.	Remarks.
A14E1 A14N	2	Bolts, tap.....	For pawl-shaft bearing.....	S.....	0.375 x 1.125. 0.5 x 1.25.
	2	do.....	For filler pieces.....	S.....	
	1	Cam.....	On elevating arm.....	S.....	
	3	Cam screws, counter-sunk.....	Cam to elevating arm.....	S.....	
	1	Case.....	On filling piece.....	Bz.....	Consisting of 1 firing leaf cord and hooks, 1 lanyard cord and hook, and 1 reel cord with ring and thimble.
	1	Case cover.....	In case.....	Bz.....	
	1	Extension (complete).....	Near breech of gun.....	.....	
	1	Filling piece.....	On elevating band.....	Bz.....	
	1	Nut.....	For spring shaft.....	S.....	
	1	Pawl.....	On pawl shaft.....	S.....	
	1	Pawl shaft.....	In pawl-shaft bearing.....	S.....	
	1	Pawl-shaft bearing.....	On elevating band.....	Bz.....	
	1	Pawl spring.....	Between pawl and case.....	S.....	
	1	Pin.....	In reel.....	S.....	
A14J1	1	Reel.....	In case.....	Bz.....	Riveted.
A14B	1	Spring.....	do.....	S.....	
A14F	1	Spring shaft.....	do.....	S.....	
A14M	1	Spring shaft pin.....	In spring shaft.....	S.....	
A14C	1	do.....	In case.....	S.....	Do.
	1	Studs.....	In filler piece.....	S.....	Do.
	1	Taper pin.....	In pawl shaft.....	S.....	

## SAFETY FIRING SWITCH

P30F	2	Blades.....	Attached to lever (P30T).....	C.....	0.375 x 0.5.
P30E	2	Blocks.....	For blades (P30F) and clips (P30G) and (P30H).....	H. R.....	
P30S	6	Bolts, tap.....	For covers (P30Q1) (P30P1).....	S.....	
P32A	3	do.....	For lever base (P32B).....	S.....	
P30AM	1	do.....	For clip base (P30AH).....	S.....	
P30V	1	do.....	do.....	S.....	
P30D	4	Bushings.....	For blades (P30F) and clips (P30G) (P30H).....	H. R.....	
P30N	1	do.....	On lever pivot (P30R).....	Bz.....	
P30G	2	Clips.....	Riveted to clip blocks (P30J).....	C.....	
P30H	2	do.....	do.....	C.....	
P30AH	1	Clips, base.....	On top carriage.....	C. I.....	0.25 x 1.875, riveted 0.25 x 0.437. 0.25 x 0.437. 0.187 x 0.75.
P30J	2	Clips, blocks.....	In clip base (P30AH).....	C.....	
P30P1	1	Cover.....	For blades (P30T).....	S. S.....	
P30Q1	1	do.....	For clips (P30G) (P30H).....	S. S.....	
P30T	1	Lever.....	On lever pivot (P30R).....	C. I.....	
P32B	1	Lever base.....	On chassis.....	C. I.....	
P30R	1	Lever pivot.....	In lever base (P32B).....	S.....	
P30C	4	Nuts.....	On blades and clips.....	S.....	
	2	Pins.....	In lever base (P32B).....	S.....	
	1	Pin.....	In lever (P30T).....	S.....	
	1	do.....	In clip base (P30AH).....	S.....	For lever pivot.
	4	Rivets.....	In clip blocks (P30J).....	C.....	
	2	Split pins.....	In blades (P30F).....	S.....	
	2	do.....	In clip blocks (P30J).....	S.....	
	1	Standard spring cover No. 1.....	On lever (P30T).....	S.....	
P30AD	1	Stop.....	In lever base (P32B).....	C. I.....	
	1	Taper pin.....	do.....	S.....	
P30B	2	Washers.....	On blades (P30F).....	S.....	
P30B	2	do.....	On clip blocks (P30J).....	S.....	

## FIRING PISTOL

P39D1	1	Binding bolt.....	In spring insulation (P39H4).....	Br.....	
P39J	1	Binding post.....	On buzzer board (P39AS3).....	Br.....	
P39X	1	do.....	do.....	Br.....	

## FIRING PISTOL—Continued.

Piece mark.	Number.	Name of part.	Location.	Material.	Remarks.
P39S	2	Binding-post cables.....	From binding bolt (P39D1) and from binding stud (P39AB) to binding post (P39J).	C.....	Insulated.
P39W2	2	Binding-post screws.....	In binding post (P39J).	S.....	
P39Q	1	Binding screw.....	In spiral screw nut (P39AN1).	Br.....	
P39AB	1	Binding stud.....	In spring insulation (P39H4).	Br.....	
P39F1	2	Bolts, tap.....	For bracket.....	S.....	0.625 x 2.25.
	2	do.....	1 in magnet header (P39AE) and 1 in spiral (P39AJ1).	Br.....	
P39Z2	2	Bushings.....	For terminals.....	H. R.....	Screwed into pistol cover (P39A1).
P39AK2	1	Buzzer (complete).....	Pivoted below magnets.		Made up of bushing of vulcanized fiber, 2 steel rivets, 1 brass buzzer handle, 1 brass buzzer hammer, 1 armature of magnet iron, 2 brass contact springs, and 2 brass rivets.
P39AS3	1	Buzzer board.....	Secured to pistol cover (P39A1).	H. R.....	0.625 x 2.5 x 2.656.
P39AQ1	2	Buzzer-board nuts.....	Moulded in buzzer board (P39AS3).	Br.....	
P39AP1	2	Buzzer-board, screws.....	In pistol cover and buzzer board.	Br.....	
P39AC	1	Buzzer frame.....	Below magnets.	Br.....	
P39AL1	1	Buzzer-frame bolt.....	Magnet leader (P39AE) to buzzer frame.	Br.....	
P39Y1	1	Buzzer-frame screw.....	Magnet frame (P39AC) to buzzer board.	S.....	
P39AH	2	Buzzer pivots.....	In buzzer frame (P39AC)	S.....	
P39Y1	2	Contact screws.....	In binding posts (P39J) and (P39K).	S.....	Platinum tip.
P39AU	1	Filler piece.....	Under retaining catch.....	S.....	
	1	Firing pistol bracket.....	On sight standard.....	Bz.....	
P39T1	2	Header screw.....	Magnet header to buzzer board.	S.....	
P39AA1	2	Magnet bars.....	In magnet spools (P39U3).	Mg. I.....	
P39AE	1	Magnet header.....	On buzzer board (P39AS3).	S. I.....	
P39AR	2	Magnet screws.....	Magnet header to magnet bar.	S.....	
P39U3	2	Magnet spools.....	On buzzer frame (P39AC).	H. R.....	Wire wound.
P45C1	2	Nipples.....	For bushings (P39Z2).....	Bz.....	
	1	Pin.....	For firing pistol bracket.....	S.....	Driven.
P39N	2	Pistol bolts.....	Top of pistol frame (P39C1).	Br.....	
P39A1	1	Pistol cover.....	On firing pistol bracket.....	Bz.....	
P39C1	1	Pistol frame.....	Slides over pistol cover.....	Bz.....	
P39AD2	1	Push button.....	In pistol frame (P39C1).....	Br.....	With fiber tip.
P39AF	1	Push-button gland.....	do.....	Br.....	
P39AG1	1	Push-button spring.....	do.....	Br.....	
P39R1	1	Resistance spool.....	In buzzer board.....	H. R.....	
P39B2	1	Retaining catch.....	Riveted to pistol cover.....	S.....	Tempered.
P39AJ1	1	Spiral.....	On buzzer board.....	S.....	With platinum tip.
P39AM3	1	Spiral screw.....	Spiral to buzzer board.....	Br.....	
P39AN1	1	Spiral-screw nut.....	In buzzer board.....	Br.....	
P39H4	1	Spring insulation.....	On pistol cover (P39A1).	H. R.....	
P39G	2	Spring-insulation screw.....	Spring insulation (P39H4) to cover.	Br.....	
P39L3	1	Trigger.....	In pistol frame.....	Br.....	With insulation.
P39M	1	Trigger pivot.....	do.....	Br.....	
P39K	1	Trigger spring.....	On spring insulation.....	Br.....	Platinized.
P39E2	1	Washer.....	Under binding bolt (P39D1).	Micinite.....	
		Wire.....	On resistance spool.....	G. S.....	
		do.....	On magnet spool.....	C.....	

## AMMUNITION TRUCKS (3 PER CARRIAGE).

Piece mark.	Number.	Name of part.	Location.	Material.	Remarks.
	2	Arms.....	On frame and cartridge pans.	W. I.....	Riveted in place.
	1	Axle.....	In frame and cartridge pans.	F. S. No. 2....	
59P	1	Bearing.....	On frame.....	Bz.....	For caster.
	1	Bearing (upper).....	do.....	Bz.....	Riveted.
	1	Bearing (lower).....	do.....	Bz.....	Do.
	1	Bevel gear (large).....	Under plunger.....	C. I. No. 2....	
	1	Bevel gear (small).....	do.....	C. I. No. 2....	
	2	Bolts, countersunk with nuts.....	For plunger stop.....	S.....	
	2	do.....	For brake-shaft bearings.....	S.....	
	4	do.....	do.....	S.....	
59M	10	Bolts with nuts.....	For buffer cylinder.....	S.....	0.5 x 1.75.
	1	Bolt with nut.....	In tray stop.....	S.....	0.4 x 5.25.
	1	Bracket.....	On frame.....	Bz.....	
	1	Brake lever.....	On brake shaft.....	S.....	
	1	Brake-lever guide.....	On frame.....	S.....	
	1	Brake shaft.....	In break-shaft bearing.....	S.....	
	2	Brake-shaft bearings.....	On frame.....	Bz.....	
	2	Brake shoes.....	On brake shaft.....	C. S.....	1 right and 1 left.
59L	1	Buffer cylinder.....	On frame.....	C. S. No. 2....	
59D	1	Buffer spring.....	In buffer cylinder.....	S.....	
59G	2	Caps.....	In stirrup.....	Bz.....	
	1	Caster.....	In bearing on frame.....	C. S. No. 3....	With 2 felt packings.
	1	Caster wheel.....	In caster.....	C. S.....	With rubber tire.
	1	Caster-wheel pin.....	In caster wheel.....	F. S.....	
	1	Collar.....	On caster.....	F. S.....	
	2	Collars.....	On axle inside of wheels.....	Bz.....	With felt washers.
	2	do.....	On axle outside of wheels.....	Bz.....	Do.
59C	1	Crank.....	In bracket on frame.....	F. S.....	
	1	Cylinder head.....	In buffer cylinder.....	S.....	
	1	Elevating head.....	On plunger.....	C. S.....	
	1	Elevating screw.....	In plunger.....	F. S.....	
	2	Filler pieces.....	On shot tray.....	W. I.....	1 short and 1 long.
59A	2	Followers.....	On buffer cylinder.....	Bz No. 4....	
	1	Frame and cartridge pans.....	On wheels.....	S.....	Complete.
	2	Gaskets.....	For plugs (59E).....	C.....	
59B	1	Gasket.....	In cylinder head (59C).....	C.....	
59K	2	Glands.....	In followers.....	Bz. No. 4....	
	2	Guides.....	On bearing upper.....	S.....	
	1	Handle.....	In arms.....	Ash.....	
	1	Handwheel.....	On screw.....	C. S.....	
59N	2	Keys.....	For buffer cylinder.....	S.....	
	2	do.....	For bevel gears.....	S.....	0.375 square.
	1	Key.....	In caster pin.....	S.....	Do.
	1	Nut.....	In plunger.....	Bz.....	
	1	Oil pipe.....	In frame and step.....	Br.....	
	3	Oil plugs.....	In wheels.....	Bz.....	0.5 standard.
	2	Pins.....	In stirrup.....	S.....	Riveted.
	1	Pin.....	For filler piece.....	S.....	
	1	do.....	In shot tray.....	S.....	With square key.
59J	1	Piston and rod.....	In buffer cylinder.....	S.....	Complete.
59E	2	Plugs.....	do.....	S.....	
	1	Plunger.....	In bearings.....	W. I.....	
	4	Rivets.....	For keys.....	S.....	0.25 diameter.
	4	do.....	For bearing upper.....	S.....	0.625 diameter.
	9	do.....	In plunger.....	S.....	0.5 diameter.
	4	do.....	For bracket.....	S.....	0.625 diameter.
	8	do.....	For tray support.....	S.....	0.375 diameter.
	4	Rivets, countersunk.....	On shot tray.....	S.....	Do.
	8	do.....	do.....	S.....	0.625 diameter.
	1	Roller bearings.....	For caster wheel.....	Bz.....	With 8 steel rollers
	2	do.....	For truck wheel.....	Bz.....	each.
	1	Screw.....	In elevating head.....	F. S.....	
	6	Screws, fillister head.....	For guide (59K).....	S.....	0.625 x 1.375.
	2	Set screws.....	For brake shoes.....	S.....	0.5 x 0.75.
	1	do.....	For brake lever.....	S.....	0.375 x 0.7.
	1	Shot tray.....	On elevating head.....	W. I.....	
	1	Split pin.....	In stirrup.....	S.....	
	2	Split pins.....	In shot tray pin.....	S.....	
	2	do.....	In caster pin.....	S.....	
	1	Step.....	In frame.....	Bz.....	
	1	Step washer.....	In step.....	F. S.....	
59F	1	Stirrup.....	On upper bearing.....	C. S. No. 2....	Hardened.
	1	Stop.....	On frame.....	W. I.....	
	1	Taper pin.....	In stirrup.....	S.....	
	1	do.....	For collar on caster.....	S.....	
	1	do.....	In handwheel.....	S.....	



## AMMUNITION TRUCKS (3 PER CARRIAGE)—Continued.

Piece mark.	Num ber.	Name of part.	Location.	Material.	Remarks.
	1	Tray stop.....	On shot tray.....	S.....	With rubber tires.
	1	Tray support.....	do.....	Bz.....	
	2	Truck wheels.....	On axle.....	C. S.....	
	2	Washers.....	For brake-shaft bearing.....	S.....	
	4	do.....	do.....	S.....	

## ELECTRICAL EQUIPMENT.

V18U	1	Base.....	In terminal box (V18B).	Slate.....	Pipe, 1 right and 1 left.	
P50A	1	Battery box.....	On rear of left chassis.....	Oak.....		
T44H	1	Battery-box bracket.....	do.....	S.....		
P50E	1	Battery-box connection.....	On battery box (P50A)...	Bz.....		
	2	Braces.....	For 3 conduit.....	W. I.....		
T5H	1	Bracket.....	On chassis over elevation disk.....	W. I.....		
P50G	2	Bolt, countersunk with nuts.....	For battery-box connection (P50E).....	S.....	0.25 x 1.125.	
V18Y	2	Bolt, expansion.....	For conduit strap base (V18J).....	S.....	0.875 x 12.	
V18AA	16	Bolt, special.....	For terminal (V18Z).....	Bz.....	0.25 x 2.125.	
V18EA	4	do.....	For terminal (V18DA).....	Bz.....	0.375 x 2.25.	
	1	Bolt, tap.....	For bracket (T5H).....	S.....	0.5 x 1.	
V18N	4	Bolts, tap.....	For terminal box (V18B).....	S.....	0.75 x 1.75.	
V18P	8	do.....	For terminal box cover (V18C).....	S.....	0.625 x 1.5.	
V18X	2	do.....	For conduit strap (V18W).....	S.....	0.75 x 1.25.	
	2	do.....	For shade bracket (T45C).....	S.....	0.5 x 1.125.	
	3	do.....	For shade (T45B).....	S.....	0.5 x 0.75.	
	2	do.....	For starting rheostat bracket (T45F).....	S.....	1 x 1.5.	
	2	do.....	For shade bracket (T45E).....	S.....	0.5 x 1.	
E14D	4	do.....	For plug box (E14B) and hook (E14C).....	S.....	0.5 x 1.25.	
	2	do.....	For pipe support (T44A).....	S.....	0.625 x 1.125.	
	2	do.....	For braces under chassis.....	S.....	0.875 x 1.5.	
	4	do.....	For Junction box (T44D).....	S.....	0.5 x 0.875.	
	2	do.....	For pipe support (T44E).....	S.....	0.625 x 1.125.	
	3	do.....	For battery-box bracket (T44H).....	S.....	0.5 x 1.	
	1	do.....	For connection (T44Q).....	S.....	0.5 x 1.375.	
	4	do.....	For junction box (T44J).....	S.....	0.5 x 0.875.	
	8	do.....	For strap (T44G).....	S.....	0.5 x 1.	
	2	do.....	For strap (T44L).....	S.....	0.625 x 1.125.	
	5	do.....	For strap (T44N).....	S.....	0.5 x 1.	
P45K	23	do.....	For strap (P45Q).....	S.....	0.5 x 1.	
P45K	1	do.....	For strap (P45R).....	S.....	0.5 x 1.	
P45K	2	do.....	For strap (P45S).....	S.....	0.5 x 1.	
	2	do.....	For pipe support (P44A).....	S.....	0.5 x 0.875.	
E12AA	5	do.....	For twisted hooks (E12Y).....	S.....	0.375 x 0.812.	
P50B	2	Bolts, with nuts.....	For battery box (P50A).....	S.....	0.625 x 2.25..	
	4	do.....	For starting rheostat bracket (T45F).....	S.....		
	3	do.....	For elbow (T44B).....	S.....		0.75 x 2.25.
	1	do.....	For elbow brace (T44M).....	S.....		0.75 x 1.625.
	2	do.....	For elbow brace.....	S.....		0.75 x 2.625.
V23AM	2	Bushing.....	Near side lamps on chassis.....	C. I.....	0.5 x 0.75.	
V23BM	2	do.....	do.....	C. I.....	0.5 x 1.	
P45M3	2	do.....	In terminals.....	H. R.....	Commercial.	
	3	Candelabra lamps.....	For azimuth pointer, elevation disk, and throttling valve.....			
			On lamp fitting (T45A).....	Bz.....		
E12S	1	Cap.....	In battery box (P50A).....	C.....		Do. Complete.
P50C	6	Cells, O. K. dry battery.....	In battery box.....	M. I.....		
V23HA	5	Cells, connections.....	In junction box (T44F).....	M. I.....		
V23AW	1	Chase coupling, .5.....	do.....	S. S.....		
P51D	1	Clip base plate.....	On clip base (P30AH).....	C.....		
P51A	1	Clip base studs.....	In clip blocks (P30J).....	C.....	Insulated.	
V23MT	1	Close nipple, .75.....	In junction box (T44F).....	W. I.....		
V23LT	4	Close nipple, .5.....	On .5 conduits.....	M. I.....		
(1)	Conductor.....	For portable lamp (E14A).....	C.....			
V18NA	(2)	Conduit 3, flexible.....	For terminal box.....	S.....		
V18JA	2	Conduit fitting.....	On ends of 3 flexible conduit.....	Bz.....		
V18W	1	Conduit strap.....	In pit.....	S.....		

1 20 feet.

2 10.5 feet.

## ELECTRICAL EQUIPMENT—Continued.

Piece mark.	Num ber.	Name of part.	Location.	Material.	Remarks.
V18J	1	Conduit strap base.....	In pit.....	S.....	
T44Q	1	Connection.....	For .5 conduit.....	C. I.....	Near azimuth pointer.
P45Z1	1	Contact fork connection.....	On firing circuit.....	C.....	
	1	Controller box.....	On starting rheostat bracket (T45F).....	C. I.....	Commercial.
	1	Controller panel (complete).....	In controller box.....		Do.
E12V	3	Couplings.....	Near candelabra lamps.....	Bz.....	
V23AA	9	Couplings, .5.....	On .5 conduits.....	C. I.....	Right and left.
V23BA	2	Couplings, .75.....	On .75 conduits.....	C. I.....	Do.
V23DA	1	Couplings, 1.5.....	On 1.5 conduits.....	C. I.....	Do.
V23EA	2	Couplings, 2.....	On 2 conduits.....	C. I.....	Do.
V23FA	1	Couplings, 1.....	On 1 conduits.....	C. I.....	Do.
V23CA	2	Couplings 1.25.....	On 1.25 conduits.....	C. I.....	Do.
V18HA	2	Coupling nuts.....	On conduit fitting (V18JA).....	Bz.....	Do.
V18C	1	Cover.....	On terminal box (V18B).....	C. I.....	
T44C	2	Covers.....	For junction boxes (T44D) (T44J).....	C. I.....	
V23AJ	2	Elbows, .5.....	Near elevation disclamp.....	M. I.....	
T44B	1	Elbows.....	On 3 conduits.....	C. I.....	In center of carriage.
T44P	2	Elbows, braces.....	For elbow (T44B).....	W. I.....	Pipe.
T44M	1	.....do.....	.....do.....	W. I.....	Do.
	5	Firing cables.....	On carriage.....	C.....	Armored.
V18K	1	Gasket.....	For terminal box (V18B).....		Garlock packing.
P45F	1	Ground connection.....	On gun.....	S.....	
P50F	4	Hasp and hook (complete).....	On battery box (P50A).....	Br.....	
E14C	1	Hook.....	For portable lamp.....	Bz.....	
T44D	1	Junction box.....	Between chassis.....	C. I.....	
T44J	1	.....do.....	Outside left chassis at rear.....	C. I.....	
T44F	1	Junction box and cover.....	Inside left chassis at center.....	C. I.....	
T45G	1	.....do.....	Between chassis over motor.....	C. I.....	
	3	Lamps (16 candle-power).....	On chassis and rear transom.....		Commercial.
E9H	2	Lamps.....	For sights.....		Do.
E12R	1	Lamp fitting.....	For azimuth lamp.....	C. I.....	
T45A	1	.....do.....	On top carriage.....	C. I.....	
E12Q1	3	Lamp spring.....	In reflector.....	Bz.....	
P51E	1	Lever plate.....	On safety firing switch.....	S. S.....	
P51B	2	Lever studs.....	In blades (P30F).....	C.....	
P50D	12	Lugs.....	On battery connections.....	C.....	
V18V	20	Marking plates.....	In terminal box (V18B).....	S. B.....	
P5K	2	Nipples.....	In battery box connection (P50E).....	Bz.....	
E12T	5	Nuts.....	Near candelabra lamps.....	Bz.....	
P45H	9	.....do.....	On terminal (P45AD).....	Bz.....	
P51J	8	.....do.....	For terminal studs (P51B) (P51C).....	S.....	Both sides chamfered.
V18BA	48	.....do.....	For bolts (V18AA).....	Bz.....	0.25.
V18FA	12	.....do.....	For bolts (V18EA).....	Bz.....	0.375.
V23AN	3	Outlet insulator, .5.....	On .5 conduit.....		Commercial.
V23CN	1	Outlet insulator, 1.5.....	On 1.5 conduit.....		Do.
V23DN	1	Outlet insulator, 2.....	On 2 conduit.....		Do.
	5	Packing.....	For cells in battery box.....	F.....	
V18H	1	Pad.....	In terminal box (V18B).....	S. R.....	
	2	Pins.....	In pipe fitting (V18KA).....	S.....	Driven.
	40	Pins (special).....	For marking plates (V18V).....	Br.....	0.08 x .375 driven.
	1	Pipe.....	Top of sight standard to coupling (V23AA).....	W. I.....	0.5 insulated.
	1	.....do.....	Coupling (V23AA) to coupling (V23AA).....	W. I.....	Do.
	1	.....do.....	.....do.....	W. I.....	Do.
	1	.....do.....	.....do.....	W. I.....	Do.
	1	.....do.....	Coupling (V23AA) to junction box (T44J).....	W. I.....	Do.
	1	.....do.....	Outlet insulator (V23AN) to junction box (T44F).....	W. I.....	Do.
	1	.....do.....	Plug box (E14B) to elbow (V23AJ).....	W. I.....	Do.
	1	.....do.....	Tee (V23AC) to cross (V23BF).....	W. I.....	Do.
	1	.....do.....	Junction box (T44F) to coupling (V23AA).....	W. I.....	Do.
	1	.....do.....	Coupling (V23AA) to connection (T44Q).....	W. I.....	Do.

## ELECTRICAL EQUIPMENT—Continued.

Piece mark.	Number.	Name of part.	Location.	Material.	Remarks.
	1	Pipe.....	Tee (V23BC) to coupling (V23AA).	W. I.....	0.5 insulated.
	1	do.....	Coupling (V23AA) to coupling (V23AA).	W. I.....	Do.
	1	do.....	Coupling (V23AA) to plug box (E14B).	W. I.....	Do.
	1	do.....	Outlet bushing (V23AN) to switch (E13B).	W. I.....	Do.
	1	do.....	Cross (V23BF) to switch (E13Q1).	W. I.....	Do.
	1	do.....	Bushing (V23AM) to socket holders (E13AG).	W. I.....	Do.
	1	do.....	Junction box (T45G) to coupling (V23BA).	W. I.....	0.75 insulated.
	1	do.....	Junction box (T44F) to coupling (V23BA).	W. I.....	Do.
	1	do.....	Junction box (T44D) to coupling (V23BA).	W. I.....	Do.
	1	do.....	Cross (V23AF) to tee (V23BC).	W. I.....	Do.
	1	do.....	Cross (V23AF) to junction box (T45G).	W. I.....	Do.
	1	do.....	Cross (V23BF) to coupling (V23JA).	W. I.....	1 insulated.
	1	do.....	Junction box (T45G) to coupling (V23JA).	W. I.....	Do.
	1	do.....	Junction box (T44J) to outlet box.	W. I.....	1.25 insulated.
	1	do.....	Junction box (T44D) to coupling (V23DA).	W. I.....	1.5 insulated.
	1	do.....	Coupling (V23DA) to outlet bushing (V23CN).	W. I.....	Do.
	1	do.....	Coupling (V23EA) to coupling (V23EA).	W. I.....	2 insulated.
	1	do.....	Coupling (V23EA) to junction box (T44J).	W. I.....	Do.
	1	do.....	Outlet bushing (V23DN) to junction box (T44J).	W. I.....	Do.
	1	do.....	Elbow (T44B) to junction box (T44D).	W. I.....	2 insulated.
	1	do.....	Elbow (T44B) to flexible conduit (V18NA).	W. I.....	Do.
V18KA	1	Pipe fitting.....	On 3 conduit.....	Bz.....	
V23G	1	Pipe plug, 3.....	In elbow (T44B).	C. I.....	
V23B	1	Pipe plug, .75.....	In .75 cross (V23AF).	C. I.....	
T44A	1	Pipe support, 1.5.....	On motor bracket.....	S.....	
T44E	1	Pipe support, 2.....	On rear of left chassis.....	S.....	
T44L	1	do.....	Outside left chassis.....	S.....	
V18T	1	Plate.....	In terminal box (V18B).	S. B.....	
P51G	4	Plate bushings.....	In lever and clip base plates.	Bz.....	
P45T	9	Plug.....	In terminal (P45A).	Bz.....	
E14B	2	Plug boxes (complete).....	For portable lamp (E14A).		Furnished by Engineer Department.
E14A	1	Portable lamp (complete).....	Hung from side of left chassis.		Do.
T45H	1	Racer insulation tube.....	In racer near azimuth pointer.	H. R.....	
E13AJ1	5	Receptacles.....	For candelabra lamps.....	Vulcanized asbestos.	
V23BB	1	Reducing coupling.....	On conduit.....	C. I.....	
E12P1	3	Reflectors (complete).....	For candelabra lamps.....	Br.....	
P45P1	2	Receptacles.....	In terminal connections.	Bz.....	
P50H	28	Screws, countersunk.....	For hasps and hooks (P50F).	Br.....	
	3	Screws, round head.....	In junction box (T44F).	S.....	
V18Q	2	do.....	For pad in terminal box.	Bz.....	
V18S	4	do.....	For plate in terminal box.	Br.....	
	3	do.....	In junction box (T45G).	S.....	
T45D	1	Shade (complete).....	In center of carriage.....	S.....	
T45B	2	do.....	On chassis.....	S.....	
T45C	2	Shade brackets.....	For shade (T45B).	S.....	
T45E	1	Shade bracket.....	For shade (T45D).	S.....	
V23CT	2	Short nipples.....	In conduit.....	W. I.....	
V23DT	1	Short nipple, 2.....	do.....	W. I.....	Insulated.
V23HT	1	Short nipple, 1.....	do.....	W. I.....	

## ELECTRICAL EQUIPMENT—Continued.

Piece mark.	Number.	Name of part.	Location.	Material.	Remarks.
P45J1	10	Sleeves.....	In terminals (P45AD) (P45AF).	Bz.....	Commercial.
E13AF	3	Sockets.....	In socket holder (E13-AG).	Vulcanized asbestos.	
E13AH	5	do.....	For candelabra receptacle.	Bz.....	
P45N1	10	do.....	In terminals (P45AD) (P45AF).	Bz.....	
P45N1	2	do.....	In battery-box connection (P50E)	Bz.....	Do.
E13AG	3	Socket holders.....	For sockets (E13AF)....	Bz.....	
	1	Starting rheostat.....	In controller box.....		
T45F	1	Starting rheostat bracket.	On rear of chassis.....	S.....	
V23AF	1	Straight cross, .75.....	For conduit.....	C. I.....	For lighting cables.
V23BF	1	Straight cross, 1.....	do.....	M. I.....	
T44G	8	Straps.....	For .5 conduit.....	S.....	
T4Q	5	do.....	do.....	S.....	
T28Y	1	Strap.....	On top of sight standard.	S.....	
T44N	1	do.....	For .75 conduit.....	S.....	
P45R	1	do.....	For one .25 conduit.....	S.....	
P45S	2	Straps.....	For two .25 conduit.....	S.....	
P45Q	27	do.....	do.....	S.....	
T4M	1	do.....	On top of sight standard.	S.....	
P51H	4	Stud bushing.....	In plate bushings.....	H. R.....	Do.
E13B1	2	Switches (complete)....	Top carriage and elevation disc.		See 14-6-13.
E13Q	1	Switch (complete).....	On left chassis.....		Do.
P45G1	10	Swivels.....	In terminals (P45AD) (P45AF).	Bz.....	Consisting of 1 staple, 2 nuts, and 1 strap.
V23AC	1	Tee, .5.....	For .5 conduit.....	M. I.....	
V18Z	32	Terminals.....	In terminal box (V18B).	C.....	
V18DA	8	do.....	do.....	C.....	
V18B	1	Terminal box.....	In pit.....	C. I.....	
V18E	1	Terminal-box fitting.....	In terminal box (V18B).	Bz.....	
	2	Terminal connections.....	In battery box (P50A)...	C.....	
E12X	5	Thimbles.....	For 2 cables.....	G. I.....	
E12Y	5	Twisted hooks.....	do.....	S.....	
T44K	1	U strap (complete).....	For 3 conduit in pit....	S.....	
E12Z	5	Verona washer.....	For twisted hooks (E12Y).	S.....	Insulated. Do.
P45AA1	10	Washers.....	In terminals (P45AD) (P45AF).	H. R.....	
P51K	2	do.....	For clip base stud (P51A).	S.....	
P45AA1	2	do.....	In battery-box connections (P50E).	H. R.....	
V18CA	32	do.....	For terminals (V18Z)...	Bz.....	
V18GA	8	do.....	For terminals (V18DA)...	Bz.....	
V18R	2	do.....	For pad (V18H).....	Bz.....	
	1	Wire, No. 14.....	For firing circuit.....	C.....	
	1	do.....	For lighting circuit.....	C.....	

## WAR DEPARTMENT,

## OFFICE OF THE CHIEF OF ORDNANCE,

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